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REPORT

OF THE

COMMISSIONER OF PATENTS

FOR THE YEAR 1861.

AGRICULTURE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1862.

IN THE HOUSE OF REPRESENTATIVES,
April 24, 1862.

Resolved, That there be printed, for the use of the members of this House, two hundred thousand extra copies of the Patent Office Report on Agriculture for 1861, and fifteen thousand extra copies for official distribution by the Department of the Interior.

REPORT

OF

THE COMMISSIONER OF PATENTS.

PATENT OFFICE,
Washington, January 30, 1862.

SIR: I have the honor to transmit herewith the portion of my report relating to Agriculture, with papers appended the preparation of which was directed under the act of Congress of March 2, 1861, making an appropriation for agricultural statistics and investigations, and the procurement and distribution of seeds, &c.

These papers embrace a great variety of topics connected with the agricultural interests of the country. The most elaborate one is from the pen of D. J. Browne, esq., who, about the first of May last, was appointed to visit Europe to investigate the cultivation and manufacture of flax. The result of his labors will be found in a highly interesting paper, herewith submitted. In visiting establishments where practical and important information was to be obtained, Mr. Browne enjoyed facilities rarely extended to others, and has thus been enabled to present a report which will be read and studied with great interest by those who feel interested in the development of this branch of industry. He would have been able to furnish a report even more full in details, had not the limits of this volume precluded a greater length.

A large proportion of the fund appropriated to this bureau has been expended in the purchase and distribution of seeds, cuttings, &c. From the 31st of December, 1860, to the same date in 1861, there were distributed 2,474,380 parcels of garden and flower seeds, embracing 154 varieties of the former and 230 of the latter. Most of these seeds were purchased by my predecessor, and if not as valuable as they might have been, the responsibility does not rest upon the present Commissioner. Several varieties of flower seeds were procured which have not been distributed, but destroyed, because of their objectionable qualities, some of them being noxious weeds, injurious to meadows and other grass lands.

About one thousand bushels of wheat, imported from different parts of Europe, have been distributed, the results from which, however, are not known.

Oats and barley of a superior quality have also been distributed.

The osier willow has been propagated most successfully, and forty-five thousand roots and cuttings will be distributed the present season. It is believed that its cultivation will prove profitable to the agriculturist, and largely bene-

ficial to the country. Large quantities of this willow and its manufactures are now imported into this country. It has been demonstrated beyond all controversy that it can be produced here as cheaply and in quality equal to any other country.

THE PROPAGATING GARDEN.

In the spring of 1858 a dozen or more species of American grape roots and considerable quantities of cuttings and grape seeds were planted in this garden, with a view to the identification of species or varieties, the hybridization of American with European varieties, and the production of new varieties from seeds of the hybridized fruit.

In the summer of the same year a gentleman from Germany, who had been practically engaged in wine making in that country, was employed by the office to aid in the novel and interesting experiments in progress. Arrangements were also made at the same time with an eminent chemist in Boston, conjointly with the gentleman last referred to, and several wine manufacturers in New England, to determine the following points in regard to American native grapes, cultivated or wild:

1. Whether any, and if any, what, varieties contain at maturity the elements of good wine that will keep and bear transportation.

2. Whether any, and what, varieties are deficient in any wine-forming elements, or contain any ingredient, either in quality or quantity, injurious to good wine or pernicious to health.

3. To determine in what parts of the fruit said elements exist, and ascertain whether, and how, any such deficiency or excess can be remedied, and such injurious properties neutralized, reduced, or removed.

4. Not only the fruit but the vines themselves were to be carefully observed; their leaves, their vigor of growth, and freedom from disease; their soil, climate, habitat, and period of maturity; and the seeds of remarkable varieties collected and planted for experiment and trial.

Under these arrangements some forty species and varieties of grapes were collected and submitted for analysis to the chemist, who not only determined the percentage of sugar, tartaric acid, &c., contained in each, but believed he had discovered the cause of, and a simple remedy for, the musky or foxy flavor peculiar to our wines. It was ascertained that our native grapes generally contained in abundance the elements of good wine, and, in most cases, tartaric acid in excess.

From some cause this investigation closed when it bid fair to develop facts so important. It is proposed to resume it during the coming season, to the end that pure domestic wines may supplant the vile and poisonous adulterations, foreign and domestic, now in use, and that there may be saved to the country the considerable sums of money now sent to Europe for foreign wines.

With these remarks upon the details of the workings of the office, the Commissioner ventures to submit some considerations, which reflection and his expe-

rience in this place have suggested to him, in regard to the great material interests of the country which, partially and indirectly, are now under the charge of the Patent Office. These considerations involve an enlargement of the functions hitherto exercised by the office, and look to a fundamental organization of a Department of Industry, to the end that comprehensive results important to the industrial concerns of the country may be achieved under the fostering care of the government.

It has long been a wonder that the people of the United States—three-fourths of whom are agriculturists, and nearly all the rest laborers of some sort—should have had Secretaries of State, of the Treasury, of War, of the Navy, of the Interior, and of the Post Office, but no Secretary of Agriculture, Manufactures, and Commerce. France has her Minister of Agriculture, Commerce, and Public Works; Italy, of Instruction, Commerce, and Public Works; Spain, of Progress, Commerce, Instruction, and Public Works; Prussia, of Commerce and Industry; Austria, of Commerce and Public Economy; and Great Britain, her President of the Board of Trade. But, except as a subordinate bureau—an appendage of the Patent Office, designed mainly, as it would seem, to furnish members of Congress "cuttings and garden seeds" to distribute among favored constituents, and tea plants, roses, and other exotics for their greenhouses and pleasure grounds—this great nation of workers has thus far had no Department of the Productive Arts. It has been constitutional to make and unmake banks, fiscal agencies, and sub-treasuries; to allow States, if not to emit bills of credit, at least to authorize corporations to do it for them; to annex foreign territory by purchase and by conquest; in short, to do almost anything except to preserve the life of the nation, or to promote the welfare of the people who toil.

While the republic remained in peace, out of debt, and prosperous—while the people were tranquil, untaxed, and happy—this policy, however defective, was tolerated; but now, when the whole civil and military power of the State is roused into action—when half a million of these workers have left the plough in the furrow, the hammer on the anvil, and the shuttle in the web, and sprung to arms—when a thousand millions of debt is to be incurred, and a hundred millions of revenue raised by taxes, direct and indirect, which must rest on the labor and productive powers of the nation at last—*it is most respectfully but earnestly submitted to the consideration of Congress that these great interests* should no longer be ignored, but that they should, at once, be recognized in the government of the State, and have awarded to them a *commissioner, with powers for usefulness in some degree commensurate with their magnitude and importance.* The several nations of Europe, according to their respective forms of government and modes of industry, differ much from each other in the powers which each has conferred upon these Ministers of Industry. France, for instance, recognizing more fully the importance of agriculture, has a Minister of Agriculture, Commerce, and Public Works, which latter term they use in a far more extended sense than we, including manufactures and patents. Great Britain, on the other

hand, has no Minister of Agriculture, but, true to her instincts and policy, has a President of the Board of Trade.

It will be for the wisdom of Congress to determine what agency, if any, shall be constituted, and what powers shall be conferred. My first intention was to recommend a Commissioner of Agriculture only; but upon a review of what other nations have done, and especially after some reflection upon the whole subject under consideration, my mind has been led to the conclusion that agriculture, manufactures, and commerce should be united under one general supervision, as in France, Italy, and Prussia. There would thus be less departure from our present system, and more economy, unity, and efficiency of operation. But the principal reason is, that the great interests of agriculture, manufactures, and commerce are *one and indivisible.* They are not antagonistic, but so entirely intertwined and dependent upon each other, that it is impossible to benefit either without advancing the interests of each, or to injure one without embarrassing all. Agriculture imparts to manufactures food and raw materials, and to commerce food and freights; manufactures furnish to agriculture clothing, tools, and a home market, and to commerce ships, railways, cars, tools, clothing, and business; and commerce, both foreign and domestic, animates and vivifies the production and interchange of commodities for both and for all. Without either, the others languish and die. And when all act harmoniously side by side—and *the nearer together the better*—then and only then do nations rise to the highest attainable point of independence, wealth, and power.

In support of this general recommendation, I propose in this report to present briefly such considerations as seem to bear most directly upon the object in view.

All the mighty dead, who laid the foundations and corner-stones of our great national edifice, and reared and cemented together its walls—Washington, Franklin, Hamilton, Adams, Jefferson, Jackson, Clay, and Webster—have left on record the sanction of their great minds and the devotion of their patriotic hearts to the promotion of agriculture, manufactures, and commerce. Their arguments and recommendations are too well known and remembered to need repetition to the Congress of the United States. But still higher authority than even the sanction of such names will be found in the great facts which underlie the subject under consideration.

I. WHAT ARE THE AGRICULTURAL RESOURCES OF THE UNITED STATES?

THE SOILS embrace all the excellences and diversities of all the geological formations of the earth's surface—the Alleghany ranges, with their forest-covered summits and extended slopes, from the Atlantic to the Ohio; the great central valley, with its drift alluvions, some portions covered by forests and others with prairies, and all boundless alike in extent and fertility; and, beyond these, the Rocky Mountain ranges, with their intermediate plains and Pacific valleys, presenting much that is barren in strong contrast with some of the most fertile soils on earth.

THE CLIMATE, constituting all that is most valuable in the north temperate

zone. It is true our climate is continental and not insular, and is, therefore, subject to greater extremes of summer heat and winter cold. We too often complain of these extremes as compared with the milder climate of England, forgetting that both extremes are highly favorable to production. When frost bites and winter roars around our homes, we should remember that *God's great ploughshare* is subsoiling and ameliorating our fields; and when our unclouded summer sun pours down his broad flood of light and heat on our harvest fields, driving man and beast to rest in the forest shades, we should not forget that God is ripening over the broad expanse of open fields the fairest fruits of earth—the peaches, grapes, and melons, the sugar-cane, the cotton, and our great national crop, Indian corn, from the Gulf to the Lakes. Other nations may produce some few peculiar products better and more surely than the United States, but it is believed that no region of earth so extended enjoys a climate so well adapted to so large a variety of valuable products as that part of the republic lying east of the Rocky mountains. From the Gulf of Mexico to the great lakes it has a most refreshing and equable distribution of rains and summer heats, so that Indian corn and many tropical fruits and vegetables ripen in great perfection, and all agricultural and horticultural crops, from the grains, grasses, vegetables, and fruits of the north to the sugar-cane, cotton, tobacco, rice, figs, and oranges of the south, attain such a profusion and perfection side by side as they do nowhere else attain; and although the vast regions west of the Mississippi valley present great diversities of heat and cold, aridity and moisture, desolation and extreme productiveness, these very contrasts open up a wide field for scientific investigations, to ascertain what crops and modes of culture are best adapted to all these diversities.

II. WHAT ARE THE CAPABILITIES OF THE UNITED STATES FOR MANUFACTURES?

A glance at these resources, it is believed, will show how far "the wish was father to the thought" when Sir Robert Peel announced that it was "the destiny of the United States to feed Great Britain, and the destiny of Great Britain to clothe the United States;" for, strange as it may sound in European, and perhaps even in some American ears, the fact is nevertheless true, that however admirably this country may be adapted to agricultural products, it is still better fitted for manufacturing industry. What are the elements of manufactures? Abundance of mineral wealth, of coal and iron, lead and copper, gold and silver, abundance of cotton and wool, and silk, and flax, and hemp; plenty of water-power and steam-power; enough of lakes and rivers, canals, railways, and telegraphs; a healthful climate, and no stint of cheap food for man; but beyond and above all, a free, enlightened, fearless, ingenious, enterprising, industrious, Christian people, willing to work with their hands, but apt and skilful to bend to their aid the finest and most efficient appliances of human art and device. In what one of all these elements are the United States wanting? There are within our limits at least four enormous coal fields. The Alleghany

coal field, covering large areas of Pennsylvania, Ohio, Virginia, Kentucky, Tennessee, and Alabama, is estimated at 60,000 square miles. Another coal field occupies the greater portion of Illinois and Indiana; the third covers most of Missouri, and the fourth the greater part of Michigan. Another small field lies on the Pacific coast, making the aggregate area of coal field in the country near 200,000 square miles. Great Britain has 11,860 square miles; Spain, 3,408; France, 1,719, and Belgium 518 square miles. Thus the United States have more than ten times as much coal as Britain, Spain, France, and Belgium united. And while, for the most part, the coal of Britain is mined at great depths, abundant strata of our coal crop out along our railways and rivers, and, mined by horizontal shafts, the coal is carried by its own weight into boats and cars.

THE IRON of Great Britain has been largely manufactured, but as well in quality as in quantity it fails in comparison with that of New York, Pennsylvania, Virginia, Tennessee, Ohio, Illinois, and the magnetic ores of Lake Superior, and of the Pilot Knob and the Iron Mountain of Missouri. Thus stands the comparison, so far as coal and iron enter into the account. To carry the comparison further, between the capacity of the two countries to produce the material for textile fabrics, or forest timber for naval and domestic architecture, or, still further, into the fields of wheat and Indian corn, where food for man and beast are grown, would seem invidious, if not vainglorious. How, then, is Great Britain to maintain her boast that it is her "destiny to clothe" America? It can be done only by the supremacy of her commercial power and the wisdom of her commercial policy, aided by our failure to avail ourselves of the means which God and nature have placed in our hands. This brings us naturally to the next subject of inquiry.

III. WHAT ARE THE COMMERCIAL FACILITIES OF THIS REPUBLIC?

Its northern frontier is skirted by the great lakes; its southern, by the Gulf; its eastern, by the Atlantic ocean; and its western, by the Pacific. Besides these oceans, for foreign commerce, we have two grand systems of internal water communication running at right angles—one east and west, and the other north and south. The first composed of the Hudson river, the Erie canal, and the great lakes, extending from our commercial metropolis half across the continent, to the heads of Lakes Superior and Michigan, affords fourteen thousand miles of navigation. The second is composed of the Mississippi and its tributaries, giving an aggregate of seventeen thousand miles. These two, interlocked as they are by the Ohio, Indiana, and Illinois canals, present a harmonious and unequalled system of internal navigation more than thirty thousand miles in extent.

The RAILROADS now in operation which concentrate at Boston, New York, Philadelphia, Baltimore, Pittsburg, Cincinnati, St. Louis, Chicago, and other points, amount to 30,000 miles. There are in the country 40,000 miles of TELEGRAPHS, extending from city to city, and from sea to sea. These works are a portion of the grand instrumentalities of internal commerce in the United

States. But the *amount* of this commerce baffles computation. Foreign commerce, far less in amount, is, from its nature, more easily calculated. We have correct tables of the total amount of our exports and imports from the organization of the government. But how shall be estimated the amount of our internal commerce? The tabular statements of the last census are not yet made up, but Senator Simmons estimated the aggregate value of the annual results of the productive industry of the country, on the basis of the census of 1840, at $2,000,000,000.

H. C. Carey, in 1858, estimated it at $3,600,000,000.

It may now be placed in round numbers at $4,000,000,000.

Of this not one-tenth is exported. The remaining nine-tenths find home markets through the channels of internal commerce.

The same is true of other countries. For example, the exports of France are less than one-eighth of the productive industry of the country. The volume of internal commerce is insufficiently indicated by the figures which express the annual value of the product of the nation's industry, inasmuch as the great mass of the products remaining at home become the subject of repeated sales and purchases. Even the commodities of foreign commerce are themselves the means of swelling internal commerce. How often is the wheat of Illinois bought and sold before it is exported, and how often are the silks and wines of France sold after they arrive at New York? So that it is within bounds to say that the internal commerce of the country is more than ten times as great and important as our foreign commerce. To those who hold, in the face of these considerations, that still foreign commerce is the more important interest, a sufficient answer is found in the words of an esteemed writer on political economy, who observes: "If wealth can come only from abroad, where does it come from abroad? From abroad also! so that in tracing it from abroad to abroad we should have to trace it beyond the confines of earth!" It is obvious that, so far as commerce is a source of great wealth, domestic has the advantage over foreign commerce, in that in the case of the former both parties to the bargain are at home, whereas in case of foreign commerce half, at least, of the benefit of the trade goes into the coffers of the foreign merchant.

With this review of the resources of the country, agricultural, manufacturing, and commercial, which have hitherto stood without a Minister to represent them, I should, in ordinary times, deem it unnecessary to say more, but there is much in the present condition of the country that is worthy of special consideration. We are in the midst of a great revolution, not only social and political, but industrial and economical. Thus far the best efforts of the great minds of the nation have necessarily been directed mainly to the consideration of the former; but the day is fast coming when the latter will command the attention that is its due. It is true that first of all the rebellion must be crushed out, and its political consequences met, involving the need of the wisest statesmanship to preserve and extend liberty, do justice, and heal dissensions. This will not be all. There will be a debt of hundreds of millions, less or more, as the war shall

be terminated sooner or later. There are few aspects of national debt other than those which suggest great burdens and great evils. It will weigh heavily on the productive interests of the country. These interests must be recognized, fostered, and organized, that they may be equal to the burden and the extinguishment of this debt. We must confront this debt as we have confronted the rebellion, resolutely. How is this to be done? If the war should, as to some it seems probable, be closed so that the army may be disbanded by July of the present year, the debt will be less in proportion to our resources than was the debt of 1816 after the last war with Great Britain, which, under the wise protective policy of Clay, and Lowndes, and Jackson, was paid off in twenty years. Fortunately, as few evils in this world are without some compensating good, the debt will, in this important respect, carry with it its best remedy. As soon as the debt of the war of 1812 was paid off, its absence gave to Mr. Calhoun his most effective weapon against Mr. Clay's protective policy. "Why raise revenue only to distribute again? Why take money out of one pocket to put into another? I will have free trade, or South Carolina will nullify your unconstitutional acts!" and although overwhelmed in the argument on the floor of the Senate by Clay and Webster, and before the people by the proclamation of President Jackson, he effected his object, and obtained the compromise tariff of 1832. But so long as the country shall remember that his free trade dogmas ended in universal bankruptcy and ruin in 1837, and his State rights doctrines ripened into rank rebellion in 1861, we are in little danger, groaning under the weight of this debt, of returning very soon either to his political or his industrial theories.

Of all the nations of the earth there is not one at whose command there has been placed an amount of resources at all to be compared with those of the United States. Not one with stores so boundless of coal, iron, copper, lead, silver, and gold; not one with such a soil and climate combined, producing such diversified products in so lavish abundance; not one with such facilities for inland transportation and for foreign commerce; not one with a people so free, and so generally enlightened, enterprising, and inventive.

Now, in the language of Mr. H. C. Carey, (Social Science, vol. 2, page 72,) "Two systems of political economy are before the world; one, whose objects are to be promoted by increasing the competition for the *sale* of all the raw materials of manufacture, labor included; and the other, which looks to increasing the competition for their purchase."

The one increases the difference between the prices of raw materials and finished commodities, while the other would secure their more close approximation.

The one looks to adding to the value of commodities, and thus diminishing that of man; the other to diminishing the value of products, and of increasing that of the men who need to use them.

The one was reprobated by Adam Smith; the other is in full accordance with his doctrines, as well as those of Colbert.

The former system is represented by Great Britain and the poor agricultural peoples whom she leads in her train, Ireland, Turkey, Portugal, Brazil, Mexico, Jamaica, India, and, ere long, China; the latter is represented, since the days of the Great Napoleon, by France, following the doctrines of her own Colbert; by the Great German Confederacy under their *Zoll-verein*, whose existence is due to the patriotic labors of Professor List; by the Empire of Russia, under the lead of Count Nesselrode; and by Norway, Sweden, Denmark, and all the north of Europe.

A glance at the operation of these systems is highly instructive.

1. And first let us look at Great Britain herself. Her seat of empire is a small and mild and beautiful island in the North Atlantic ocean. Adopting first a highly protective system she got the start of all the nations of the earth, and her policy is to keep it. And if, by her free trade writers she can succeed in persuading all the nations of the earth to work at agriculture, where every man counts one, and let her manufacture by steam, whereby every man counts a hundred, and let her ships monopolize all the profits of transportation, she will continue to be mistress of the world. Napoleon at St. Helena sadly said, "Great Britain conquered me not with her swords, but with her spindles; with her spindles she subsidized all Europe, and here I am."

The power of steam employed in Great Britain is estimated as equal to the united forces of 600,000,000 of men, and yet the total number of persons employed in the coal mines is but 120,000, two-thirds of whom raise coal for other purposes than for steam-engines, so that 40,000 men mine coal enough to do the work of 600,000,000 men. The entire population of the island at the time of the foregoing estimate (1851) was 21,000,000, each one of whom, man, woman, and child, were the power thus equally divided, would have thirty willing slaves to do his work. Slaves, too, born in full life; slaves that never tire, never fall sick, need no clothes, and eat only fire and water, costing only 40,000 men to raise food for 600,000,000.

To enable this fuel to do the work it is, however, required that man should play the part of engineer. The engineer must have his engine. But all the engines in Britain are made by 35,000 men. Adding now together the miners, 40,000, the engine-builders, 35,000, we have less than 100,000 men as the total human force given to the development of a natural one equal to 600,000,000, the physical force of each being thus multiplied *six thousand times*. It is by means of this mighty power, aided by her carrying trade, and her absorption of all the earnings of all the agricultural nations who submit to her system of trade, that Great Britain has heaped up her vast wealth, now estimated at £6,000,000,000 sterling, or $30,000,000,000. It is by these means that she collects a revenue of $355,000,000. It is thus that she supports her monarchy, her aristocracy, her hierarchy, her army, her navy, her civil list, and pays the interest on her national debt of £800,000,000, or $4,000,000,000.

But what is the effect of this system upon the nationalities which are subject to her commercial sway?

At the close of the fifteenth century Portugal had passed the Cape of Good Hope, and established her power throughout India. Lisbon speedily rose to occupy a chief place among the cities of Europe. But the splendor of Portugal in the sixteenth century, resulting from her robbery of the East, had been attended by increasing weakness, and less than a hundred years found her a Spanish province. Before the lapse of another century she had attained her independence, and we find her importing foreign artisans to manufacture her fine wool, and succeeding so well as fully to meet the home demand. But in 1703 she signed the famous Methuen treaty, by which, in consideration of certain favors to her wines, the idea of creating at home a market for food and wool was entirely repudiated. At once her markets were flooded with British goods, her manufactures were ruined, and all her money was sent abroad. Her soil was exhausted by export of agricultural staples, her population declined, her roads went to ruin. While all Europe progresses, Portugal remains stationary. All the resources of the state are exhausted; corn has failed; grapes have failed; whole classes of people are reduced to utter poverty, while in Madeira men perish by thousands for want of food. *The nation which begins by exporting only raw products of the soil must in the end export or starve its population.*

Turkey in Europe and Asia is the garden of the eastern continent. Wool, silk, corn, tobacco, oil, and cotton might be produced in abundance. Coal, and iron, and copper are found in great quantities; and yet the people are scarcely one degree above slaves, and the government is sneered at as "the sick man!" Why is this so? Two centuries ago the Turks were among the richest merchants in Europe. A few years later Turkey united with France and England in a treaty to admit their goods at a duty of only three per cent., and their vessels into her ports free, thus granting to them absolute free trade. Revenue from customs being thus cut off, direct taxation was resorted to by the government, in the shape of poll taxes, house taxes, and land taxes, and, with these, export duties. Great Britain invented machinery for spinning cotton, and prohibited its export as well as that of all artisans, thus compelling all the cotton of the world to come to her mills to be manufactured. Turkey had been accustomed to sell her cotton in the form of cloth, but now found that her manufactures by hand and small looms ceased. Of 600 looms at Scutari in 1812, but 40 remained in 1821; of 2,000 factories at Tournovo in 1812, but 200 remained in 1830. Since then these manufactures have entirely ceased. Women's wages were reduced to four cents a day, and men gathering mulberry leaves and feeding silk-worms could earn but five cents a day. Landed proprietors were ruined, families impoverished, while villages disappeared. In many districts the whole rural population abandoned the cultivation of their native soil and migrated to the nearest cities. Not only is the foreigner free to introduce his wares, but, on payment of only two per cent., to carry them throughout the empire until sold, and then bear off the money as suddenly as he came. The result of this free trade is the ruin of all local commerce as well as manufactures, the storekeeper who paid rent and taxes having found himself unable to con-

tend with the travelling peddler who paid neither. The consequence is, that in the great valley of Buyukdere, known as the "Fair Land," near Constantinople, a property twelve miles in circumference was sold in 1850 for five thousand dollars! and in the neighborhood of Smyrna land may be purchased for six cents an acre! Domestic commerce having thus dwindled, the whole amount of foreign commerce has become entirely insignificant. As Portugal and Turkey have become thus entirely dependent, there has been a decline in their power to consume British fabrics; and thus has the fable of Æsop of the goose that laid the golden eggs been realized.

Ireland, under the operation of the same system, in 1841 had a population of 8,175,124; in 1851, 6,515,794—decrease, 1,659,330; in 1861, 5,764,113—decrease, 787,843. Decrease of population in twenty years, 2,447,173.

Thackeray says, "Throughout the west and south of Ireland the traveller is haunted by the face of the popular starvation. In this fairest and richest of countries men are suffering and starving by millions. There are thousands of them at this minute stretched in the sunshine at their cabin doors, with no work, scarcely any food, and no hope." Such a state of things is accounted for by those who attempt to make England a *workshop* and all the rest of the world *one great farm*, by saying that the population of Ireland was too numerous for the land; and yet the county of Mayo, paying a rent of $1,500,000, has 800,000 acres of waste land, of which more than half is reclaimable. Galway county, paying $2,165,000, has upwards of 700,000 acres of waste land, of which 410,000 are reclaimable. The barony of Ennis, that abomination of desolation, has 230,000 acres of land to its 5,000 paupers. And yet the London Times, in announcing these startling facts, says, in characteristic cold blood, "*For a whole generation man had become a drug in Ireland and population a nuisance.* The inexhaustible Irish supply had kept down the price of English labor, but this cheapness of labor had contributed vastly to the improvement and power of England, and largely to the enjoyment of those who had money to spend."

India, until subjected by the East India Company, enjoyed peace, plenty, and a great share of personal liberty. Enjoying the little farm of his forefathers, the simple Hindoo gave himself no concern whatever as to the intrigues of the capital. There are no privations which he will not endure rather than abandon the spot where he was born, and if oppression drive him forth he will return to it again, after long years of exile, with fresh fondness, to die.

The Mohammedan conquest left these simple, beautiful institutions untouched. Each Hindoo village had its distinct municipality. Taxes were heavy, but locally expended. Neighbor could exchange with neighbor. Bengal was celebrated for the finest muslins, and the Coromandel coast was equally celebrated for the best chintzes and calicoes. Under these circumstances it is no matter of surprise that the country was rich. From the date of the battle of Plassey, British power was established. Step by step the company advanced, and everywhere adopted the Hindoo principle that the sovereign, as proprietor of the soil and sole landlord, was entitled to one-half the gross produce of the land. Under

the earlier Mohammedan rulers this land tax was limited to a thirteenth, and from that to a sixth, the company exacting one-half.—(See Rickard's India.) But what was infinitely worse, having the monopoly of trade, the company dictated the price of sales and purchases. Just imagine 100,000 revenue officers sole magistrates of justice, and every subordinate rent collector a policeman, vested with power to fine, imprison, and flog any inhabitant within his range on any charge without oath or evidence of record.—(See Thompson's Lectures on India.) The looms were taxed, the children were taxed, all tools were taxed, kings, princes, poor manufacturers, and cultivators of earth, all were taxed to the utmost limit of endurance, *and this system is still in force.*

Cotton abounded, and fifty years ago so great were the labors of men, women, and children applied to its manufacture that they not only supplied the home demand for the beautiful tissues of Dacca and the coarse products of western India, but exported to other parts of the world 200,000,000 pounds of cloth per annum. In 1813 the cry was raised in England that the East India Company did not export enough of the fabrics of British industry, and thereupon the trade of India was thrown open; *but the restriction on the export of machinery and artisans was maintained in full force.* Such were the circumstances under which the poor Hindoo had to meet the competition of British steam-engines in his own market, while all his hand products were carefully excluded from hers. The result was that in ten years the exports of cotton goods from Bengal had declined to £285,121, and in twenty years to not one piece. Thus perished the industry and commerce of India under the oppressive grasp of the British system. Macaulay, and no man knew better, says: "Enormous fortunes were rapidly accumulated at Calcutta, while 30,000,000 of human beings were reduced to the utmost extremity. They had been accustomed to live under tyranny, but never tyranny like this. They found the little finger of the company thicker than Surajah Dowlah's loins. Under their old masters they had at least one resource; when the evil became insupportable the people rose and pulled down the government. But the English government was not to be shaken off. That government, oppressive as the most oppressive form of barbarian despotism, was strong with all the strength of civilization. It resembled the government of evil genii rather than the government of human tyrants."

Thus have we passed in review Great Britain herself and four of her principal victims, Portugal, Turkey, Ireland, and India, comprising in the whole two hundred millions of men—nearly one-fifth of the population of the globe. Other nations might be added, so as to embrace all the countries in the world, in which a large *proportion* of its labor is given to the work of *transportation*, for this is the *great obstacle to human improvement*, to the development of intellect, to the growth of freedom, and to the increase of commerce. Wherever the farmer is placed side by side with the artisan, little is lost in the transfer of their commodities. They mutually benefit each other and aid each other in their triumphs over nature, and civilization ensues; but wherever, on the contrary, the manufacturer disappears and the gap becoming wider and wider between raw materials

and fabrics, there arises a necessity for exporting commodities in an unfinished state, the tendency is directly the reverse. Man is relapsing into poverty, slavery, and barbarism. This is the case in all the countries subject to the system which looks to having but a *single workshop* for all the world, to which are to be sent all the products of the earth at infinite cost of transportation. Why is pork worth but $2 50 per hundred in Illinois and wheat but 25 cents in Iowa? Why are poor lands worth $100 per acre in New Jersey and rich lands in Kansas worth nothing? Only because the farmer in Jersey has a consumer at his door and shops all around him.

It will be said that the Turks are Mohammedans; that the Hindoos are indolent; that the Portuguese and Irish people have a religious faith adverse to the development of mind; that the laborers of Jamaica are but little removed from barbarism, and that *these* are the causes of the growing weakness of these several peoples. But the Turks were Mohammedans more devoted a century ago than now; they were then prosperous. So were the enlightened Moors of the south of Spain. The Portuguese are no more Catholic now than were their fathers who made the celebrated, but to them ruinous, Methuen treaty. They and the Irish people hold the same faith with those of France and Italy, among whom agriculture and all the arts are now so rapidly advancing. The negroes imported into Jamaica were no more barbarian than were those received into Virginia and Carolina; and yet while each of these latter is represented by seven of his descendents, the British islands present but two for every five. So that differing in faith, color, and climate, all these communities under British sway, compelled to become tillers of the earth, have ended in poverty, slavery, famine, pestilence, and death.

We turn now to another picture. The downfall of Napoleon the Great brought peace to the world in 1815, the arrival of which was hailed as the harbinger of universal prosperity and happiness, but instead thereof, brought universal ruin! The mills and furnaces of the United States and of Continental Europe closed. Manufacturers were ruined. Farmers were ruined, because of the inability of carpenters, masons, spinners, weavers, miners, and metal workers to earn food. Men wondered and asked each other the cause. Such a state of affairs that had made peace a calamity far greater than war necessarily led to inquiry. The active American and plodding German began to read and think. They took up the great text-book of political economy, "The Wealth of Nations," and there read that the great commerce of every civilized society is that carried between the inhabitants of the town and those of the country; "that the corn which grows within a mile of town sells for the same price as that which comes from twenty miles distant, and that the latter must pay the expense of bringing it to market." They found their markets too far off, and going further and further. They found they lost most of the value of their crops in the cost of *transportation*, and that many things could not be exported at all. On every page of that great work they found that the only condition of prosperity was *that the producer of raw materials and the producer of fabrics take their places*

side by side. They read the utterances of British statesmen and found that it was their avowed policy to crush out American and continental manufactures, and that a brilliant future would make amends for present loss. They turned to Adam Smith again, and saw that he denounced this as a manifest violation of the most sacred rights of nations. A reaction began in the United States, gallantly led off by Mr. Henry Clay, in 1816. The German Customs Union, or *Zoll-verein*, began in 1820. Russia, under the lead of the great Count Nesselrode, and the United States, still under the lead of Clay, followed in 1824. France, reading the works of her great Colbert, adopted the same policy, and has never really abandoned it. Louis Napoleon talks free trade, but makes treaties for protection. Denmark, Spain, Sweden, and Norway, all adopted the same policy and still maintain it. What have been the results?

Denmark, compared with India, Ireland, or Turkey, is by nature a poor country. She has no minerals, no steam-power, no harbors, except on the Baltic, little foreign commerce; with little to spare in her cold corner, she still provides for herself everything by her industry, protected by heavy duties to bring together the farmer and the artisan. The greater part of the people's clothing is home-made. The flax and wool are grown and manufactured on the peasant's farms. The spinning and weaving done in the house, the bleaching dyeing and fulling done at home or in the village. Under a different system the *money* price of the clothing would be less, but what would become of this *labor power?* Cloth is cheaper in Ireland, but where is the money to buy it? In the language of the *London Times*, "man is so cheap *as to become a nuisance, fit only to go in rags and to starve.*" The Dane has a comfortable cottage with floors of wood, and outside of the meanest cottage are his little yard and garden; the windows rarely lack a little bit of ornamental drapery, and are always decked with flowers and plants in flower pots. The whole people have a passion for flowers, and they have everywhere leisure to be "happy, educated, and amused."

Spain, a few centuries ago, had a greater diversification of employments than any country in Europe. Prior to the expulsion of the industrious and enlightened Moors, the kingdom had thirty millions of people. It now contains but half that number. Mexico and Peru, the East and the West Indies, Italy, and the Netherlands, were in turn plundered; home industry was abandoned; artisans and farmers died out; towns and cities decayed, and land became more and more monopolized by the nobles and the church. Fortunately for Spain, she lost her colonies, and was compelled to look at home. From that time her course has been upward. Forty years ago farmers owned but twenty millions of her lands. Two-thirds of all her domain were held by the nobility and the church. The property of the church was sold, and the number of small owners who work their own lands increased from 273,000 to 546,000. In short, the agriculture, manufactures, and commerce of Spain have doubled in the last twenty-five years. She has begun again her career of conquest in Dominica and Mexico, with what results *time will tell.*

The German Confederation now embraces 45,000,000 people. The conti-

nental blockade of Napoleon was the cradle of the manufactures of Germany as well as of France. At the return of peace in 1815 the manufactures of Britain came here, as elsewhere, into competition. For a time the doctrines of free trade prevailed, but in 1818 the Prussian manufacturers were heard, and the Prussian tariff was enacted, which put a stop to the system of those who had been told by Mr. Brougham that "England could afford to incur some loss on the export of English goods, for the purpose of destroying foreign manufactures in their *cradle*." Germany, at that time, was disunited. In 1819 Prussia brought to her side a few smaller States. Convocations were held at Darmstadt in 1821, at Frankfort, in 1823, and at Stutgard, in 1825, but the result seemed hopeless. At the head of the opposition stood Hanover, entirely controlled by British influence, Saxony, whose nobles maintain free trade, and Hesse, where the feudal interests were still powerful. In 1828 a confederation of thirteen States was formed to check the doctrines of protection. In 1831, Hesse abandoned the confederation and joined Prussia. In 1833 Bavaria, Wurtemburg, and Saxony did the same. In 1835 Baden, Nassau, and Frankfort joined. In 1837 the revenue of the *Zoll-verein* amounted to 16,000,000 thalers, in 1852 to 22,000,000. Austria maintained a hostile attitude till 1853, when she resolved to unite in the league. By this most important movement all northern Germany became one great society, with perfect freedom of circulation and *retaining all its local centres*. The results of the German *Zoll-verein* have been:

1. That the prices of farm products have advanced, and the prices of all fabrics declined.

2. The export of *fabrics*, instead of raw materials.

3. The increase of commerce, revenue, population, intelligence, and general comfort. The amusements of the Germans are of higher character than those of England. Only two in every hundred young men cannot read. Lands are infinitely divided, and every man, however poor, feels that he may become a landed proprietor. Eighty years ago the Elector of Hesse, in the language of Lord Chatham, "bartered his subjects to the shambles of Britain." Now, so much has intelligence and protection advanced the people of that Electorate, that our rebels, did they but know it, are conferring upon us no *reproach* by calling us, as they persistently do, "*Hessians*."

Russia fifty years ago was almost nothing but an agricultural people. Her exports ranged at less than $50,000,000. The continental system gave her manufactures a start, but at the closing of the war the Emperor Alexander naturally sided with his last ally, Great Britain, in favor of the omnipotence of trade. But the result proved most disastrous. British goods flowed in, and Russian gold flowed out. The government was paralyzed, and manufactures ruined. In this state of things Count Nesselrode, in 1824, inaugurated a new system looking to the protection of that great empire. Commerce and manufactures began to grow, and in 1834 Russian cloth was carried to Asiatic fairs. Since then the progress has been so great that the markets of central Asia are

supplied by Russian looms. From that time to the present the system has been steadily pursued, and the agricultural products of the Empire are at least thrice as great as those of France. Prices have advanced, agricultural products find a home market. Few such products, except *wheat*, will bear export, and of that only one hundredth part of the annual yield is exported. The food is all consumed by those who make cloth, mine gold, iron, and coal, build ships and factories. Of linen, 550,000,000 yards, and 100,000,000 pounds of wool, are annually manufactured. It is but a little more than twenty years since the first cotton mill in Russia was erected. The quantity of fine goods now manufactured is 3,000,000 pieces, sufficient to supply the Empire. The effect of this system is so manifest in the prosperity of the people that Baron Haxthausen, a recent traveller, says that he saw twenty-three farms purchased, together with their own freedom, by serfs of Prince Koslovski, for 50,000 roubles, three-fourths of which was paid in cash; and in another case the serfs of Prince Viazemski purchased his estate and their own freedom for 129,000 roubles. But the most significant proofs of the progress of Russia are to be found in the Emperor's decree of emancipation to all the slaves in the Empire, and her successful defence against the combined power of England and France in the Crimean war, to say nothing of her great progress since down the Amoor to the Islands of the Chinese seas.

From this rapid review the following conclusions would seem to follow inevitably:

1. That under what is called "free trade" that nation which has the start in capital, steam power, and skill, can crush and enslave her neighbors.

2. That Great Britain had the ability to do so at the fall of Napoleon in 1815; that she has crushed Ireland, Portugal, Turkey, and India; that the only safety to China and Japan is in their policy of isolation, which is crumbling fast, and they are doomed also.

3. That France, Spain, Italy, Germany, Russia, Sweden, Norway, and Denmark, shook off the shackles more or less perfectly, and prospered in that proportion.

4. That the United States took the lead of all the nations in adopting, as early as 1816, the protective policy after the fall of Napoleon; that France, Germany, Russia, Spain, and the north of Europe followed our lead.

5. That the United States reaffirmed this doctrine in 1824, 1828, 1842, and 1861; that they never abandoned it but under threats of nullification and disunion; that they have always prospered under protection, and have sped to ruin under free trade.

6. That our resources, agricultural, manufacturing, and commercial, are unrivalled, and ought without further delay to be recognized by Congress, and a suitable minister appointed to represent them.

If it be asked what there is for this Minister of Industry to do, I answer, *work enough*—to analyze soils, classify climates, introduce into different regions the best and most appropriate domestic animals, grains, grasses, fruits and vege-

tables obtainable at home or abroad; to encourage the use, everywhere, of the best tools and implements of husbandry; to promote scientific surveys; to develop the vast mineral wealth of the country; to collect statistics, agricultural, mechanical, and commercial, for the use of Congress and the people. A new era is upon us. We are to purge ourselves from "*the cankers of a calm world and a long peace.*" The false and bastard aristocracy that puffed itself up and dreamed of empire—that longed for titles of nobility, and sighed for the hated institutions of kings—is to pass away before the strong arms of American freemen. This fair land is to be renovated. Diversified pursuits are to be multiplied. The wheat lands of the north and the cotton lands of the south have been too long robbed of their wealth under a false system of trade. *That should be so no longer.* Like the lands of New Jersey, under late judicious culture, they may be restored and made better and better from year to year. We have exhaustless stores of marl, and gypsum, and lime to do it. Millions of acres along our southern coast and in the lower Mississippi delta are to be reclaimed, and to produce, under enlightened culture, the precious Sea Island cotton, as well as rice and sugar cane. The southern ranges of the Cumberland and Alleghany mountains, now neglected and worthless, are to be covered with vineyards and peach orchards, and flocks of merino sheep, like those of Vermont and Western Pennsylvania. The cultivation of cotton and sugar, instead of being narrowed, is to be extended into the middle States, by importations of new varieties of plants and by judicious selections of the earliest ripening varieties from our own fields.

Worthless breeds of cattle are to be supplanted by the short-horns on rich pastures, the Devons for the hills, and the hardier choice varieties of our natives for the mountains; so that beef, milk, and butter may abound. All other classes of domestic animals, in many districts, need entire renovation. The best agricultural tools, ploughs, drills, reapers, mowers, and threshers are everywhere to supersede the present rude implements of many districts.

The vast deposits of coal, iron, salt, gypsum, lime, and marble of Virginia, Kentucky, Tennessee, and Alabama, as well as the copper and gold of East Tennessee and North Carolina, are to be wrought and yield their stores of wealth. Factories and villages are to spring up in those healthful and genial climes, where their inhabitants can get abundance of apples, pears, peaches, and grapes—where they can enrich themselves, and bless the surrounding regions with employment, wages, and a home market. New Mexico, Colorado, Utah, California, Oregon, and Washington are to furnish millions of happy homes, and to supply our currency with silver and gold, and our sideboards with the choicest wines. The mechanic arts, under wise legislation and the ample resources of the country, are not only to spring up in the south, but to prosper with renewed vigor in the north.

The few obstructions that remain to a perfect union of all sections of the country in commercial intercourse are to be removed; the St. Clair flats are no longer to stand in the way of the commerce of the great lakes; the Illinois is to

be made a ship canal; the only obstruction to the navigation of the Ohio removed; the Cumberland river is to be made navigable, so as to carry the fruits, and lumber, and coal, and iron, and salt, and carbon oils of the mountains to Nashville; the Muscle shoals, the only obstruction in the Tennessee river, to be overcome by a better canal, so as to make that river navigable to Knoxville, and to carry out the minerals, fruits, and grains, and beautiful marble of East Tennessee. The great system of railroads throughout the northwest, now extended through Cincinnati and Louisville almost to Danville, are to be connected, by the railroad recommended by the President, with the great system of southern roads now centering at Knoxville, whereby a vast interchange of fruits of different climates and products of different mechanic arts are to be interchanged almost instantaneously, and the peoples of the south and the great northwest bound together in ties of interest, social intercourse, marriage, and consanguinity. These great bonds of union are already nearly completed, and require but these few links, which would cost comparatively nothing, to unite and weld them together.

And while the mines, and fields, and workshops of the interior are thus called into action, furnishing the material and the demand for foreign commerce and the coasting trade, the channels of the Chesapeake bay and its tributaries, the Albemarle sound, Port Royal, Savannah, Mobile, and New Orleans are to be improved, and commercial cities spring up at the south as at the north.

Our republic is a world within itself. It presents a field broad enough for the ablest Minister of Industry, with three bureaus—one agricultural, one mechanical, and one commercial. The cost need be but trifling, the benefits incalculable, so that we foster our industry, diversify its pursuits, study economy, pay our debts, reward merit, honor bravery, love liberty, cultivate peace, and drink deep at the wells dug by our fathers.

D. P. HOLLOWAY,
Commissioner.

Hon. G. A. GROW,
Speaker of the House of Representatives.

THE HISTORY, INDUSTRY, AND COMMERCE OF FLAX.

BY D. J. BROWNE.

AMONG the numerous commodities which contribute in one form or other to the clothing necessities of the human race, there is no single product of greater importance than the *Linum usitatissimum*, or what is better known as the flax plant. There certainly is no material susceptible of textile adaptation more closely identified with the progress of civilized man, none which has been so uniformly subservient to his wants, and which, through all the vicissitudes of climate, change of locality, and the various phases of his industrial, mercantile, and social career, has been so readily and so usefully convertible into fabrics, either by machinery or by hand. But the marked success with which its manufacture has been crowned in modern times has mainly been achieved by industrial energy, which has ever formed the best capital of nations, and the true basis of individual wealth. No matter how great the natural resources of a State, or however extended its domains, its prosperity must be founded on the agricultural, manufacturing, and mercantile greatness of its people, rather than on the spontaneous riches of its soil, the eligibility of its motive power, or the number and capacity of its harbors, navigable waters, or streams. No greater proof of this need be adduced than the relative position of those countries in which the linen industry has been marked with extended and triumphant results, as will be seen on the perusal of its progress as set forth in subsequent parts of this report.

The history of flax and its industry belong to nearly every nation of the globe; and, taking the Sacred Volume as our guide, we can readily follow its migrations from the early advents of its culture down to modern times. In Egypt, the cradle and nurse of civilization and the arts, flax was extensively cultivated for the manufacture of linen, where it formed the raiment of the wealthy and refined portions of society while living, and was employed as the only appropriate fabric for protecting their bodies from decay when dead. It is evident (Exod. ix, 31) that flax and barley were grown at the same time, and not unlikely in a similar rotation as the prudent agriculturist adopts at the present day, implying that flax was one of the leading crops. Moreover, we find depicted on the monuments the Egyptian peasant, as he existed some four thousand years ago, cultivating and preparing the plant; and the weaver represented in plying his shuttle to the warp, exhibiting the same processes as adopted in more recent times. But, perhaps, one of the most singular circumstances connected with the flax plant is that of its being subjected to the same tardy processes of preparation at present as it did, in all probability, in Egypt of old. The steep-pools of Ulster and Livonia, as well as the watercourses of Flanders, furnish the media for the most delicate and uncertain conversion that the plant undergoes, precisely as did the Nile to the flax-grower four thousand years ago.

From Egypt, the cultivation of flax is easily followed to Palestine, where it formed an equally prominent feature in the industrial pursuits of that country, as is attested by Solomon, when alluding to the "spindle" and the "distaff" in the working of flax by the "virtuous woman," as well as by the prophets Isaiah and Ezekiel, who have left graphic impressions of the manufactures and com-

merce of the two great marts of maritime activity, Tyre and Sidon, in Phœnicia, where this material must have extensively prevailed, both in a wrought and in an unwrought state; for it was the leading staple of Egyptian export on the one hand, and on the other, among the cherished articles of general request throughout the holy land. It was, also, the Phœnicians, it may be stated, who first imparted to the Egyptians the skill of preparing and making "fine linen" at Memphis and Thebes.

In progressing down the stream of time, we find, in Greece, the Athenian maidens preparing flaxen yarn by the same simple process (the spindle and distaff) as those of Egypt had done before them, and as now may be witnessed in some of the rural districts of Madeira, Teneriffe, and the Spanish peninsula at the present day.

From Greece, we trace this branch of industry to Carthage, and to Marseilles, as well as to Rome; and, under the sway and wide dominions of the latter, the use of flax, doubtless, became general; and, as an article of prime necessity, has been cultivated in most of the countries of Europe ever since. The citizens of that empire adopted linen for their ordinary apparel in warm weather, and even in winter it was partially used, a woollen garment being added to protect the wearer against the cold.

At the downfall of the Roman empire, when the tide of barbarian retrogradation poured in, threatening to annihilate every trace of manipulative art, the spindle and the distaff escaped, and flax, as of old, supplied the material for clothing, and probably will thus continue to do until the end of earth. The "flax plant," in short, has administered to the material wants of civilized man through every stage of his mingled career, and is capable of being converted by his skill into the finest as well as the humblest raiment he possibly can require. Moreover, from its flexibility or power to thrive under almost every degree of temperature incident to vegetation, it grows in all countries, from the neighborhood of the tropics to the northern polar circle, wherever the air is not chilled by mountain elevations, maintaining a healthy condition, varying only with occasional atmospheric peculiarities; but in some situations it is found among the spontaneous products of the soil. It may be thought strange, perhaps, that this plant should thrive in the hot valley of the Nile, and in regions so cold as those of the north of Russia, in the 65th parallel of latitude; but this circumstance is explainable when we consider how rapidly this product completes the cycle of its growth, and that, in the north of Europe, it is an object of culture only in summer, and in Egypt in the winter, being sown in the latter in December and January, just as the Nile has quitted the fields, and is harvested the following April or May. In the north of Russia it is sown in April and May, and harvested in August and September; the conditions of the climate of the two places at those periods being nearly the same.

This plant is also remarkable in having a tendency to seek littoral regions, as best affording the requisite supply of moisture, in which its fibre attains its most perfect quality, as is strikingly exemplified by referring to the countries where it is most produced. Beginning with the continent of Europe, we find that the north of Portugal and the provinces of Spain, which lie on the Bay of Biscay, produce considerable quantities of flax, while the proportion grown in the interior is comparatively small. Tracing the entire Atlantic margin of France quite round to its northeastern angle, we observe that it holds a conspicuous rank among the staple crops; and, entering Belgium, we again find the maritime provinces of East and West Flanders and Antwerp to be its chief seat; while the Dutch frontier, Friesland and Zealand, on the North sea, is celebrated for the growth of flax. As we proceed eastward, on entering the Scandinavian peninsula, bordering on the Baltic, we discover that Hanover, and Prussia, and the Russian provinces Courland, Riga, Pskow, Revel, and Petersburg furnish the bulk of the flax which enters into European commerce, and that the last traces

of the plant occur along the shores of the White sea. Again, the illustration is further strengthened by referring to the entire coasts of the British isles, as well as to the regions adjacent to the great lakes of North America, both in Canada and the United States, where the climate is moist and the flax plant is cultivated to a greater or less extent.

"The cotton plant," on the contrary, useful as it is, and widely as it enters into the clothing of mankind, is a dainty and delicate product when compared with flax, and it is only under certain conditions of climate, in respect to the degrees of temperature and the amounts of sunshine, rain, and moisture during certain seasons of the year, and in a soil of a peculiar formation, composition, aspect, elevation, and proximity to the sea, that it is capable of putting forth a proper length and structure of fibre for the finer classes of goods; and the regions are so limited in which these conditions prevail, that this delicate plant must forever decline to yield the requisite amount of the raw material to supply the increasing demands

As a remedy for this deficiency, the culture of flax on an extended scale, with its several conversions, is suggested, and is especially desirable at the present time in all countries adapted to its growth. Judiciously managed, where the labors of the farm are not suffered to encroach one upon another, and looking forward to the convenience and benefits that would result therefrom, perhaps there is no individual crop which requires so little skill and attention that affords so ample a remuneration for the outlay; for if due care be taken with respect to assolement, rotation, good tilth, with the proper manuring or amendments for serial crops of a healthy and vigorous growth, an occasional breadth of flax would yield to the farmer as profitable a return as a harvest of roots, hay, or grain. But before these results can be obtained, the usual modes of cultivating and preparing flax in most countries should undergo material modifications if not a thorough change. Instead of dealing with the plant as heretofore, that is, "rippling," or separating the seed from the straw, "rotting," or steeping the straw, drying the same after steeping, and divesting the fibre of the woody parts of the plant by "breaking," "scutching," "hackling," &c., which have been considered as purely agricultural operations, they should be regarded as strictly manufacturing operations; and where the labor of the husbandman ends, that of the manufacturer should begin. The farmer should content himself simply by producing the straw, either with or without the seed, and leave the subsequent processes of conversion to those who have special establishments for the purpose, with necessary fixtures and appliances, and whose capital and skill can be more economically and successfully employed. Flax would then be much more generally cultivated; a ready market would be at hand as soon as it is harvested or pulled; and the farmers would have no occasion to object to the trouble and risk, as now, in the case, which is liable to be entailed upon them in the subsequent manipulations of the crop.

With these facts and circumstances before them, it might be well for capitalists and agriculturists to direct their attention to the subject, in order that they may reap the manifest advantages which might be derived, either by cultivating the flax on an extensive scale and preparing the fibre for a home or a foreign market, in the scutched or hackled state, or in the manufactured form of thread and yarn, or in tissues of various kinds. By these means new resources would be added to their country; a large number of hands, agricultural and mechanical, would derive incalculable benefits from their labor; manufacturers, merchants, and others would profit by their industry and investments; important relations of reciprocity would be established among nations; and the concomitant advantages of an improved civilization would follow.

PHYSIOLOGICAL AND CHEMICAL PROPERTIES.

The flax plant, when grown to perfection, is a hardy annual, attaining a height of from two to five feet, with slender, tapering roots, penetrating deep into the soil, and a slim straw or stalk, hollow at the lower end, branching at the top, and covered by a greenish bark containing a fibre, which, when separated from the gummy and woody matter, constitutes what is ordinarily called "flax." The leaves are numerous, linear-lanceolate, with three nerves, and are sparingly disposed along the stem. The flowers are of a beautiful sky-blue,* growing in bunches at the extremities of the branches, and are succeeded by yellow globular capsules or seed-bolls, armed with sharp prickles at maturity, comprising five, or, in rare cases, only three cells, each of which contains two elliptical, fleshy seeds. In the stem there is recognized, on examination with an achromatic microscope, three distinct structures, namely, the outer skin, cuticle, or epidermis, covering a close network of concentric fibres or bundles of capillary filaments, held together by a glutinous substance, and running parallel to each other throughout the length of the plant, which enclose as in a sheath the dense pithy material of the inner parts of the stalk, sometimes called by flax-dressers the "boon."

The cuticle is composed of the same or a similar resinous or gummy substance as that which binds together the fibres, and is nearly insoluble in cold water; but when the water is warmed to a certain temperature it easily decomposes, or separates, from the other constituents, causing what is popularly known as "rotting," or steeping the plant. For this reason all judicious steepers avoid putting their flax into cold spring water, or even in water sheltered from the rays of the sun, as the object of steeping is to dissolve, or at least to soften, the cuticle and gummy matter, thereby allowing the filaments to separate, which is necessary to produce fine flax. If the steeping be continued too long the fibre itself may rot, or be weakened and injured in quality; and if not exposed to the water sufficiently long, the fibres will not be thoroughly separated from each other, and the quality of the flax will be coarse or harsh to the touch. If rotted or steeped in hot water or steam, or in alkaline solutions, the tendency also is to make the fibre more coarse, or harsh to the touch, than it would otherwise be.

Under the microscope the fibres appear vitreous and shining, resembling capillary glass tubes, about one two-thousandth part ($\frac{1}{2000}$) of one inch in diameter, jointed and cylindrical in form, breaking at right angles transversely, though rarely flattened like the filaments of Sea Island cotton, with a minute claw at one of the extremities more or less bristled or rough. It may here be remarked that linen fabrics are often adulterated with cotton, the presence of which can readily be detected under a good microscope, or even with a simple lens. The fibres of cotton present a distinctly flat transparent elongated structure, granulated on the surface, and often shrivelled in appearance, not unlike a narrow twisted ribbon, with only occasional joints. After exposure to the action of strong alkaline leys, as in bucking, they untwist, contract in length, and assume a rounded form, but still continue distinct from the fibres of flax, which retain their original structure.

In the length of the fibre we distinguish three qualities of flax, namely, in the middle, at the foot, or root end, and at the head of the plant. That of the latter is weak, though fine; that grown at the foot end is coarse, harsh, and strong; but that taken from the middle of the stalk is neither coarse nor fine, and is the best. When the fibre is very long it is sometimes cut and assorted into three equal lengths for the convenience of spinning by mill machinery, and three classes of thread are accordingly obtained.

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* In one variety the flowers are pure white.

The dried stalks of the flax plant ordinarily contain from 70 to 73 per cent. of woody matter, and from 27 to 30 per cent. of bark. The latter contains of—

	Per cent.
Pure fibrous matter	58
Matter soluble in water	25
Matter insoluble in water	17
	100

The matter insoluble in water may be separated from the fibre by the action of an alkali or soap. Pure fibre has a specific gravity of 1.5, distilled water being 1 at 6° F.

The woody matter contains of—

	Per cent.
Lignin	69
Matter soluble in water	12
Matter insoluble in water	19
	100

It was formerly supposed that the processes employed in the preparation of flax for spinning the fibre was deprived of all the constituents which the plant extracted from the soil during its growth, and that it might be regarded as possessing the same composition as cellulose of chemists. But this opinion was proved to be erroneous by Professor Hodges, of Belfast, as will be seen by the results of his analyses of samples of dressed flax, placed at his disposal, in the year 1854, which, after being dried at the temperature of 212° F., gave the following composition:

	Per cent.
Wax, volatile oil, and acid, resinous matter	2.62
Sugar and coloring matter, soluble in alcohol	0.62
Inorganic matter, soluble in alcohol	0.11
Gum and pectin	0.29
Salts, insoluble in alcohol	0.04
Nitrogenized compounds, insoluble in water	4.31
Nitrogenized compounds, soluble in water	1.39
Inorganic matter united with the fibre	1.49
Cellular fibre	89.13
	100.00

The water contained in the samples before drying varied from 9.1 to 8.61 per cent.

Thus it is shown that the fibre not only contains a portion of the inorganic matter of the plant, but that there remains locked up in the cells of the fibre a considerable amount of nitrogenized and other proximate compounds of the unsteeped straw.

The amount of inorganic matter present in the samples, by careful incineration, varied from 1.4 to 1.54 per cent. The color of the ash, in one instance, was white, and in another brick red. On analysis the composition of the ash was as follows:

	Per cent.
Potash	1.85
Soda	7.63
Chloride of sodium	1.77

	Per cent.
Lime	27.08
Magnesia	0.70
Peroxide of iron	7.40
Phosphoric acid	10.40
Sulphuric acid	3.12
Carbonic acid	19.10
Silica	21.31
	100.36

According to the investigations of Sir Robert Kane, of Dublin, the fibre, which ultimately is converted into linen yarn, is composed mainly of the same elements and combined in nearly the same proportions as sugar and starch. Omitting certain minute differences between the true fibre and the matter which occupies its cells, the combination is as follows:

	Per cent.
Carbon	50.00
Hydrogen	5.55
Oxygen	44.45
	100.00

Hence the fibre, which constitutes the entire moneyed value of the flax crop, except the seed, is produced during the growth of the plant by the elements of the atmosphere; and the materials taken from the land are in reality employed by the plant in organizing substances which do not make any return to the farmer, but which, on the contrary, under certain circumstances, are considered positively to be a disadvantage. It, therefore, should be understood that, by a proper system, the growth of flax should be void of all exhausting influences; and that the substances drawn from the soil by this crop should be found in the waste products of its manufacture, which should be made available by being returned to the land to restore it to its original fertility.

In order to ascertain what takes place during the steeping of flax, Dr. Kane instituted a series of examinations on the substances as well as the process, the general results of which are as follows:

The stem, containing its usual amount of leaves and immature capsules, gave of—

	Per cent.
Carbon	38.72
Hydrogen	7.33
Nitrogen	0.56
Oxygen	48.39
Ashes	5.00
	100.00

The ashes of the plant, treated as above, consisted of—

Potash	9.78
Soda	9.82
Lime	12.33
Magnesia	7.79
Alumina	6.08
Silica	21.35
Phosphoric acid	10.84

	Per cent.
Sulphuric acid	2.65
Chlorine	2.41
Carbonic acid	16.95
	100.00

From this analysis it is obvious that the ash of the plant contains an unusual amount of phosphoric acid, and hence the exhausting power of the crop can readily be understood. The potash, soda, sulphuric acid, and chlorine, stand in very simple relation to each other, the proportions coinciding closely with those of two atoms each of sulphuric acid and chlorine, six of potash, and nine of soda; so that if in the ashes all the soda be taken as carbonate the potash would be divided equally among sulphuric, hydrochloric, and carbonic acids.

When flax is steeped in stagnant pools or sluggish streams, the water acquires a darker hue, and a disagreeable odor arises from the solution of the glutinous matter which cements together the true fibres of the plant. In examining the steep-water, it was dried down at the temperature of 212°, one portion of the extract thus obtained being reduced to ashes, and the other reserved entire. The results of the analyses were as follows:

	Per cent. of extract entire.	Per cent. of organic matter.
Carbon	30.69	52.93
Hydrogen	4.24	7.31
Nitrogen	2.24	3.86
Oxygen	20.82	35.90
Ashes	42.01	.....
	100.00	100.00

It is thus seen that the water in which flax has been steeped dissolves out a considerable quantity of nitrogen, as well as of the inorganic materials of the stem; in fact, that it removes from the plant almost everything that it extracts from the soil, which is confirmed by examining the 42 per cent. of the ashes of the extract, as indicated by the following analytical results:

	Per cent.
Chloride of potassium	3.8
Sulphate of potash	4.4
Carbonate of potash	3.8
Carbonate of soda	13.2
Silica	5.5
Phosphate of alumina	3.2
Phosphate of lime	2.1
Carbonate of lime	4.0
Carbonate of magnesia	2.0
Per cent. of ashes	42.0

The steep-water thus dissolves, especially the alkaline ingredients and the phosphates of the plant, and hence leaves the rotted stems in a condition of almost pure ligneous matter, by which the agriculturist is to understand that he may sell the fibre to the merchant or manufacturer without taking much, if any matter, from his soil, as nearly all of the mineral ingredients which the crop may have drawn out he will still have in the steep-water, if preserved, and in the "shoves," or chaff of the scutched flax; and if, after proper decomposition and preparation, he returns these to his land, its fertility will be maintained.

After removing the fibre from the rotted stems of the flax, the shoves or residue, on analysis, were composed as follows:

	Per cent.
Carbon	50.34
Hydrogen	6.33
Nitrogen	0.24
Oxygen	41.52
Ashes	1.57
	100.00

Thus the extract of the steep-water and the shoves may be converted into manure and returned to the soil without loss; or the shoves or chaff may be used as food for the cattle on the farm with equally economical results.

The waters most favorable for rotting flax are those which are of about the same temperature of the atmosphere of the season in which the operation is performed, say from 60° to 80° F. Hence the "retteries" are ponds or pools, rivers and springs, and lastly, that of wells. In no instance should it be impregnated with iron nor calcareous salts; for it is found that water charged with iron imparts a certain color to the fibre, which is difficult to remove without injury to the thread or yarn; and that impregnated with calcareous ingredients is decomposed by the ammonia formed by the rotting process, which causes a precipitate of carbonate of lime to adhere to the fibres with which it combines, thereby rendering it harsh and dry and more difficult to spin and weave.

Flax-seed yields from 22 to 28 per cent. of oil, and from 72 to 78 per cent. of oil-cake. According to the analysis of Sprengel, the chemical ingredients of the ash of this seed are as follows:

	Per cent.
Potash	17.59
Soda	6.92
Lime	8.46
Magnesia	14.83
Oxide of iron	1.25
Phosphoric acid	36.42
Sulphuric acid	2.47
Chlorine	0.17
Silica	10.58
	98.69

HYGIENE.

An opinion has long prevailed among agriculturists, as well as physicians and others, who have been interested in public hygiene, that the operation of rotting flax, and particularly that of hemp, imparts deleterious properties to the waters of the pools and streams in which they are steeped, thereby rendering them poisonous or injurious to the fishes inhabiting them, and to the people or animals using them for drink; and that the mephitic gases evolved by the putrid fermentation accompanying the steeping contaminate the surrounding atmosphere, and thus causing the neighboring districts to be unhealthy; while others have refuted this opinion, in part, by actual experience, and have shown that they are founded on error and a want of knowledge in the nature and origin of things. In consequence of these supposed nuisances, laws have been enacted in every country of the globe in which flax and hemp have been cultivated to much extent, for the punishment of those who put these crops into pools or streams

for the above-named purposes, by depriving the offenders of the rights of fishing, by confiscation, imprisonment, and fines. Among the writers who have advocated this erroneous opinion are M. M. Bosc, Rosier, Fodéré, Baudrillard, Salviart, Christian, La Forest, Tessier, and Chasle de la Touche. Those who have expressed a contrary doctrine are M. M. Duméril, Marc, Pelletier, Villerme, Robiquet, Marcandier, Dodart, d'Argout, Andral, Biré, Mâreau, and Parent-Châtelet.

The odor which escapes from the steep-pools is very strong and disagreeable to the workmen, particularly at the time the flax is taken out, in the hotter months of the year. These fœtid emanations, which consist mainly of carbonic acid, carburetted hydrogen, sulphuretted hydrogen, and ammonia, when evolved in large quantities, no doubt affect more or less the health of the localities in which they are diffused; but, as a general occurrence, these gases are so limited in quantity when generated by the operation of rotting flax and hemp, and as the carbonic acid thus generated is chiefly absorbed by the adjacent waters or soil, and as the other gases soon become so attenuated in the surrounding air, no appreciable injury can occur to the inhabitants of the districts who respire them, as the following information will incontestably show.

In the first volume of the "Annales d'Hygiène Publique et de Médicine Légale," published at Paris in 1829, there are two memoirs relating to the rotting of flax and hemp; one by Dr. Marc, and the other a report made to l'Académie Royale de Médicine, in response to certain questions addressed to the superior authority by the municipal council of Mans, on the ground that the water in the public fountains of that city was injuriously affected by the numerous "routoirs" which existed on the supplying stream for steeping hemp. The information elicited in these two important memoirs, it is believed, is conclusive, and fully sets the matter at rest. In the course of the inquiry the four following points were considered or discussed:

1. Whether the water in which hemp has been steeped contracts by the operation unwholesome properties, and is capable of injuring those who employ it as drink.

2. Whether the water in which hemp has been steeped has any sensible action on the fishes inhabiting it.

3. Whether hemp in its various preparations acts in any manner as a narcotic or as a purgative.

4. Whether the atmosphere charged with the emanations from fermenting hemp can injuriously affect the health of those by whom it is respired.

The results of the investigations are given in fifty recorded experiments, carefully made on small birds, gallinaceous fowls, Guinea pigs, man, leeches, frogs, toads, tadpoles, and fishes of various kinds. The birds, Guinea pigs, and man (the latter in a healthy and in a diseased state) were made to partake of varied portions of macerations of green and dried hemp in water of different degrees of strength, and were exposed to the emanations from steeping hemp under various conditions and circumstances; and the reptiles and fishes were subjected, during a greater or less length of time, to water in which hemp had been steeped, of different degrees of concentration and of temperature, and were also exposed to steeps of the leaves and bark of the plane, the poplar, the willow, the alder, to red cabbage, and common hay, under similar conditions. The conclusions arrived at from these experiments may be summed up as follows:

1. It is shown that sparrows, common fowls, Guinea pigs, and man can partake with impunity, and for considerable time, macerations highly charged with the stalks of hemp.

2. That the usage of this maceration does not interfere in any manner with the increase of young animals.

3. That highly concentrated macerations of green hemp can be imbibed without sensible injury by the common fowl and by man, the latter both in a healthy

and in a diseased state; but the Guinea pig refuses them *in toto* unless diluted with ten or twelve times their weight of water, and even then they are taken with repugnance.

4. That leeches, frogs, toads, and their tadpoles can exist with impunity in macerations of hemp, but when much concentrated the latter appear to be affected.

5. That the macerations of hemp affect the vitality of fishes in proportion to their degrees of temperature and concentration, as well as the character of the species to which they are applied. These experiments confirm the general opinion, founded on observation, that *a certain quantity of hemp will veritably kill fishes* when diffused in the water they inhabit, but no more so, nor even so soon, as macerations of the leaves and bark of the plane, the poplar, the willow, the alder, red cabbage, and hay.

6. That decoctions and concentrated infusions of indigenous hemp, or the dried leaves of the same, introduced into the stomach of man, or employed as a clyster, does not act as a purgative, nor in any sensible manner on the human economy.

7. That neither the odor of hemp-fields nor the pollen of hemp flowers, when received into the nostrils, nor the leaves of the plant when smoked as tobacco, either impart narcotic or aphrodisiacal symptoms in man.

8. That the emanations thrown off from dried hemp or those constantly arising from the green plant do not act in any manner injurious to sparrows, common fowls, nor to Guinea pigs when exposed to their fumes.

9. That healthy men and women of mature age, and children from the cradle to adult, may rest entire nights exposed to the emanations of the steep-pool without being incommoded, or even running any risk of health.

10. That adult invalids afflicted with intermittent diseases may be exposed for whole days to these emanations without aggravating the disease.

11. That, from eighteen years' experience of an eminent physician of Vix, the emanations from the steep-pools were regarded as a preservative of health to the inhabitants in their vicinity, as the infrequency of intermittent fevers and the mildness of the cholera morbus, which occur in that part of France, unequivocally show.

HISTORY, PRODUCTION, AND COMMERCE.

The production of flax and its preparation for market or use, like those of almost every other staple, vary in most countries of the globe, where it is grown according to the usages, fixed habits, and economy of the people, modified in some degree by the soil, climate, rotation, and the crops with which it is associated. Hence, as the systems and customs of no two countries are precisely alike, and as those of each country have their respective advantages and defects, it has been deemed expedient to treat of this branch of the subject, with the history and progress, geographically, agreeably to the order of importance in which they may stand as connected with the linen industry, rather than to follow the arrangement usually adopted, premising that the sagacious reader may be interested in such portions of this report as may best serve his purposes or aim.

FLAX IN RUSSIA IN EUROPE.

The Russian empire, from its vast extent, abundance of fertile lands favorable to production and capacity for improvement, with the aid of low-priced labor, chiefly performed by the ex-serf population, necessarily stands at the head of the flax-growing countries of the globe. The main quantity of fibre, as a textile, is produced between the 48th and 60th parallels of north latitude and the 22d and 28th degrees of longitude east from Greenwich. In the provinces bordering on the "steppes," the Black sea, and the Sea of Azov, the plant is also

cultivated to a considerable extent mainly for the seed, the straw being used chiefly for fuel. Flax and hemp have long formed the two leading articles of Russian exports, to which, if we add oleaginous grains, taken in the aggregate, they exceed in value those of any other class of similar crops.

ITS HISTORY AND PROGRESS IN RUSSIA.

In regard to the history of this product in Russia, I have not been able to meet with any evidence of its culture either by the ancient Scythians or Sarmatians, as the former despised money and trade with other nations, lived principally on the blood and milk of cattle, and clothed themselves with their skins. It is only in the early periods of the Ruric dynasty, in about the year 879 of our era, under the reign of Oleg, that we discover an extensive use of flaxen or hempen sails in the inland fleets of that king. We read also that Olga, the Christianized queen regent, in about 969; Yaroslaf, in 1015; Ivan I, in 1362; Ivan Vasilüvitch, in 1462; and Boris, in 1584, all made efforts to improve the state of agriculture, manufactures, commerce, and the arts of the kingdom, and doubtless among them were the culture and preparation of flax.

In 1547 Ivan IV sent an embassy to Charles V, of Germany, requesting him to send a large number of artists and mechanics to Livonia and Moscow, several of whom eventually arrived, after meeting with many difficulties on the way. In 1553 he commenced his intercourse with the English, who in 1568 controlled the commerce of the Baltic and White seas, with Archangel as a centre, which, with the incorporation of the Russian company and the establishment of an English counting-house at Moscow the last-named year, gave a new impulse to the commerce of flax, which has steadily been maintained between the two countries most of the time since.

Again, this important branch of rural economy attracted the attention of Peter I, in 1721; Katharine II, in 1763; Alexander I, in 1796; Nicholas I, in 1845; and Alexander II, in 1855; all of whom respectively fostered the agriculture and commerce of the empire, and have exercised a liberal policy in the encouragement of manufactures and trade. Among the measures which have more recently been taken by the ministry of domains may be mentioned the following: Special commissions have been instituted to examine and report upon the state of the linen industry both at home and abroad, which have resulted in various publications, and the introduction of the Belgian method of cultivating and preparing flax on the farms of Gorigoretsk, Wologda, and elsewhere, thereby serving as so many practical schools. Efforts have been made to facilitate to the farmers of the western provinces the means of procuring the best seed for sowing from the government of Pskow. Models of improved machines for scutching and hackling have been obtained and sent to various districts, with the object of inducing the farmers to adopt the machines themselves. Premiums have been awarded for the best samples of flax and its manufactures, exhibited at the shows, and fairs have been established in Livonia and other parts, in order to afford facilities for the home trade. Impressed that the introduction of mechanical spinning would act as a most effective stimulus to this species of culture, the ministry has also held out liberal inducements to the first who should undertake such enterprises, and consequently numerous factories of this description have been erected within the last ten years in the governments of Moscow, Wologda, Kostroma, Kalouga, and others; and, notwithstanding the constant efforts to outrival it by the increasing use of cotton goods, the linen industry maintains the foremost rank in Russia both in point of extent and importance, and is still on the increase. It is not generally, however, like the large linen establishments in other parts of the world, nor, like the immense cotton manufactures in England or the United States, concentrated in large buildings, which strike the eye by their size, the number of operatives employed, and the ex-

tent and capacity of the machines; but it is conducted within the modest walls of the *isba*, or cottage of the peasants, diffused throughout the breadth and length of the land. There is scarcely a village within the wide domains, devoted to the growth of flax, in which the hackle, the wheel, the distaff, and the loom do not abound. In viewing the manufacture, however, on a broader scale, we find Vladimir, Moscow, Kostroma, Kalouga, and Wiazniki distinguished for their table linen; Archangel, Riazan, Novgorod, St. Petersburgh, and Moscow for their sail-cloth and duck; and Orel and Archangel for their important manufactures of cables and ropes.

In regard to the extent of the flax industry of Russia, it may be stated that linen forms one of those articles of prime necessity which no individual in the empire, however poor, can entirely dispense with. Allowing only five yards, twenty-eight inches wide, for each inhabitant in European Russia, including Poland and the grand duchy of Finland, it would require for the entire population an annual consumption of 325,000,000 yards. According to the estimate of M. Tegoborski, privy councillor to the Emperor, the gross amount of dressed and scutched fibre annually produced in the country is 163,800,000 kilogrammes, or 361,156,068 pounds avoirdupois, which, allowing 333 pounds as the average product of an acre, would require a breadth of culture of 1,084,552 acres, besides what is exclusively appropriated for the growth of fuel and seed.

In the year 1850 the exports of linen manufactures from Great Britain and Ireland amounted to 122,342,516 yards of cloth and 18,220,688 pounds of yarn, besides £358,243 worth of thread, lace, tape, and other small wares; and this immense amount followed the largest exportation of flax from Russia that had ever taken place, namely, that of the preceding year, being 192,068,597 pounds, (tow included,) 70 per cent. of which went to the United Kingdom, without reckoning the exports thither by way of Elsinore and the Russian ports; so that the entire exports of flax from Russia to Great Britain and Ireland may be safely taken at upwards of three-fourths of the whole, the remainder having been shipped to Belgium, France, Portugal, Spain, and other linen manufacturing states.

This important branch of Russian commerce, it may be stated, has gradually followed the progress of the linen manufacture in Great Britain and Ireland, and has fully quadrupled in extent since 1822, the average export of the three years preceding 1824, inclusive, being only 56,848,803 pounds, while that of 1857 exceeded 231,000,000 pounds. It is obvious, then, that the flax culture of Russia and the linen manufacture of the United Kingdom are, in a degree, mutually dependent upon one another. The latter could not maintain, and still less increase, without being sure of receiving from Russia, or some other source, an abundant supply of the raw material, at a comparatively cheap rate; and the former, on the other hand, might be at a loss for the disposal of her surplus, were she not assured of an outlet in the British markets.

The foregoing remarks and figures forcibly show the importance of the culture of this textile to the agriculture and foreign commerce of Russia, as well as to her manufactures. In the latter branch of economy she has not hitherto met with serious competition by the increased use of cotton fabrics, like other countries of continental Europe in which hemp and flax have been produced, but not in sufficient quantities for general export, owing to the relative proportion of land, as compared with the population, that can more profitably be devoted to other crops; for it is nowhere in Europe, except in Russia, that hemp and flax can be cultivated in such abundance and so cheaply, notwithstanding the backward state of her industry, the want of capital, internal improvements, and physical difficulties, perhaps impossible to overcome. It is obvious, then, that her flax culture might be rendered, at once, more extensive, and still more lucrative, by the use of improved implements and machines; a due regard to the rotation of crops; the selection of seed; a proper tilth, or working of the soil;

and a careful protection, preparation, and assortment of the products. For it is well known to intelligent cultivators that the various qualities of good flax—that is, length, color, softness, or flexibility, and the strength and uniformity of its filaments—greatly depend on the seed, the soil, and the culture, as well as on the judicious securing and rotting the crop, and in preparing it for sale. But in most, if not all, these respects, Russian practice is generally careless, and the operations usually performed in a slovenly manner, with inferior implements and tools, features which do not appear to be attributable to the soil and climate, nor to the state of the economy of the country, but to a combination of circumstances connected with the social condition, which time, enterprise, and intelligence only can remove.

SOIL AND CLIMATE OF RUSSIA AS CONNECTED WITH THE CULTURE OF FLAX.

Russia in Europe comprises an area of $2{,}078{,}646\frac{75}{100}$ square miles, of which $151{,}048\frac{61}{100}$ miles are in the northern frigid zone. The distribution of this surface has been estimated and divided as follows;

Division.	*Acres.*
Arable lands	206, 372, 315
Gardens	16, 336, 707
Meadows	30, 278, 879
Vines	234, 759
Pasturage	249, 968, 167
Woods and forests	383, 619, 774
Regions unproductive and undefined	360, 623, 345
Rivers and other inland waters	82, 899, 974
Total	1, 330, 333, 920

From reliable authority we find that the dominant character of the surface of Russia exhibits itself in a series of vast *plateaus*, or plains, more or less elevated, and interrupted by three general swells: the first, constituting the Valdai hills, in Novgorod, rising to a height of 1,175 feet above the sea; the second, a detachment from the last-named hills, commencing near Smolensk, and passing southeasterly to Penza, where it loses itself in the rocky cliffs of the Volga, with a maximum elevation of 984 feet; and the third, another detachment from the same chain of hills, running easterly from a point at the south of Witegra, in Olonetz, to the Uralians, between the northern Dwina and the affluents of the Kama.

Russia in Europe may be said to embrace nearly every variety of soil—sandy, stony, argillaceous, calcareous, and mixed. Her chief rivers, perhaps, with the exception of the Volga and a portion of the Dnieper, from the gentle declivities of their borders, are annually overflowed to a considerable extent, and a rich deposit of mud and slime is left on either side, forming a natural soil for pasturage and the growth of fibrous plants, which flourish almost unaided by the hand of man. But the most remarkable soil in the empire, and one which exists nowhere else in Europe, if we except a corner of Hungary and a small part of France, is a vast tract of black earth called *tchernozème*, lying between the 51st and 57th parallels of latitude, comprising about 247,000,000 acres, so rich that, if manured the first years of culture, the crops often prove abortive from excessive vegetation. The thickness of this deposit varies from three to six feet, and in many places it runs to an unknown depth. It is the opinion of geologists that various agents have contributed to the formation of this immense bed. At the north, it appears to be the result of the decomposition of rocks, or an admixture

of various soils; at the south, it is the sediment of an ancient sea; in the centre, lacustrine deposits prevail; and *humus*, or vegetable matter, is prominent throughout the whole.

Northward of the 57th parallel of latitude a sandy clay predominates, interspersed here and there with beds of clay and sand, unmixed. In some parts the soil is strong, while in others it is alternated by slimy marshes and moors. The polar region consists chiefly of worthless tracts, (*toundres*,) consisting mainly of marshes or bogs, abounding more or less in peat.

When the plateaus are nearly or quite destitute of trees or shrubs, they are denominated *steppes*, and may be characterized under three distinct heads, namely:

1. *Sandy steppes*, when they are covered with light sand, not arable, and rarely employed as pasture.

2. *Marshy steppes*, or those impregnated with the tides or saline waters of springs, which, in dry seasons, afford excellent pasturage for stock.

3. *Prairies*, or *vegetable steppes*, or those abounding in natural grasses and herbaceous plants, being appropriated to pasturage and cultivated to some extent with the cereal grains and other crops.

Taking a summary view of the climate of European Russia, we find that the northern district, lying between the 57th and 67th parallels, has a milder temperature than that in the same latitudes in Asia. With the exception of the wooded mountains of the Grand Duchy of Finland, at the northwest, the poor, meagre soil only insures the husbandman a return as far north as the 60th parallel. Beyond this, the winter is six or seven months in length, and travelling is generally performed in sledges drawn by dogs on the snow. Spring and autumn are foggy; summer is glaring and hot; and winter is so cold that the mercury in the thermometer sometimes congeals, and the earth and stones crack or split. Here, only slow-growing trees succeed, and beyond the 67th parallel the growth is confined to heaths and stunted shrubs, where the seasons are manifested in one long summer day, and a dreary winter night. The sky, in summer, is much overcast with vapors, which greatly obscure or entirely conceal the sun. The winter, illumed by a brilliant starlight, the aurora, and the moon, is intensely severe. Both summer and winter sensibly affect the physical condition of animals and man. But these discomforts are compensated for, in a measure, at the regions southwest, as far as the 57th parallel, by the immense tract of forests, which constitute an invaluable source of wealth, and must ever be regarded as a great blessing to the inclemency of the climate, in furnishing warmth to the inhabitants, and in serving as a shelter against the wintry blasts from the icy seas. Within this tract the government possesses 198,000,000 acres of wood. The provinces still further southward, however, have not the same necessity for this blessing; and some districts are so destitute of trees as to occasion the burning of grass, flax, and even dung, as fuel.

The great central or temperate plateau, and what has justly been called the "Industrial Region," lying between the 53d and 57th parallels, has also a rough and long-continued winter, especially in the Uralian districts, at the east, and constitutes the very heart and the wealthiest portion of the empire, in affording employment to millions of beings, both at home and abroad. The greatest national activity prevails throughout this region; and aside from the production of domestic animals, grain, roots, fibrous, and other crops, we find concentrated capital and skill in large establishments for the manufacture of flax, hemp, wool, silk, leather, the metals, and wood.

The next division which claims attention lies between the 50th and 53d parallels, known as the "Higher Steppes," and may with propriety be called the "Agricultural Region." It is in the middle and northern portions of this tract that the cultivation of the cereals, potatoes, and hemp is conducted on the grandest scale. Towards the south, where the land is more elevated, the soil

and climate are particularly favorable to the growth of tobacco, the sugar-beet, oleaginous, and other commercial plants.

Another tract, lying chiefly between the 44th and 50th parallels, known as the "Lower Steppes," which, together with the still higher region of the Upper Dnieper, may be said to constitute the "Pastoral Region" of this country. This tract, for the most part, is level and low, but little wooded, in some parts very fruitful, while in others it is unproductive and barren. The winter season is comparatively mild and short, with but little snow, although in some parts it is very cold and severe. The summer, which is from seven to nine months long, is often disturbed by long-continued drought, sudden changes of temperature from excessive heat to inordinate cold, and by violent storms of wind, rain, or hail, placing the calculations of the husbandman beyond his control.

In glancing at the "Trans-Volgian Region," we find an exception in its deltas in not possessing the fertility common to the deltas of the Nile and other large rivers. The lands adjacent to the mouths of the Volga are not periodically inundated by its waters, and consist chiefly of heaths and downs, which, though not entirely sterile, are ill adapted to the purposes of agriculture. As it seldom rains in this district in summer, the cultivators are obliged to water their gardens and fields artificially, which are situated along the borders of that stream. The heats of summer here are very oppressive, the thermometer often indicating a temperature above 100° F.; and, as a contrast, the winter is equally severe, particularly when the wind blows from the north, the mercury falling to zero, and sometimes 22° below.

The mean annual temperature of various places in Russia, as compared with that of other points on the globe, is nearly as follows:

Russia.	Fahrenheit.	Other points.
Archangel	39.20°	Rekjawick, in Iceland; Bay City, Wisconsin; Craftsbury, Vermont.
St. Petersburgh	45.05	Ullensvong, in Norway; Brandon, Vermont; Fort Edward, New York; Pomfret, Connecticut.
Moscow	45.73	Copenhagen, in Denmark; Appleton, Wisconsin; Westfield, Massachusetts.
Riga	46.18	Grœtebord, in Sweden; Manitowoc and Milwaukie, Wisconsin.
Kazan	46.63	Edinburg, in Scotland; Mendon, Massachusetts.
Orel	48.20	Bremen, in Germany; Markree, Ireland; Port Huron and Grand Rapids, Michigan; Hamilton, Upper Canada; Muscatine, Iowa; Saybrook, Connecticut; Worcester, Massachusetts.
Orenburg, Saratow	48.43	Gottingen, in Germany; Athy, Ireland; Buffalo, New York; Dubuque, Iowa; Rupert, Vermont; Shamokin, Pennsylvania.
Penza	49.10	Portrush, in Ireland; Battle Creek, Michigan; Bellevue, Nebraska; Bellport and Fishkill, New York; Fairfield, Iowa; Hiram, Windham, and Welchfield, Ohio; Marengo and Ottawa, Illinois; Meadow Dale, Virginia; Nantucket, Massachusetts; Platteville, Wisconsin; Somerset, Pennsylvania.

Mean annual temperature of various places in Russia, &c.—Continued.

Russia.	Fahrenheit.	Other points.
Ekatherinoslaw, Kharkow.	50.45	Vienna, in Austria; Brussels, Belgium; Kellybegs, Ireland; Augusta and Pekin, Illinois; Cleveland, Ohio; Flatbush and Sag Harbor, New York; Norristown, Pennsylvania; Newark, New Jersey; Richmond, Indiana.
Kiew	52.03	Castletownsend, in Ireland; Bellefontaine and Urbana, Ohio; Gettysburg, Pennsylvania; Peoria, Illinois.
Kherson, Odessa, Nicoläev.	52.93	Poitiers, in France; Belfast, Ireland; Frederick city, Maryland; Lawrence, Kansas; Madison, Indiana; Pittsburg, Pennsylvania; Ripley, Ohio; Wirt Court-house, Virginia.
Sebastopol	57.62	Venice, in Venice; Cincinnati, Ohio; Gaston, North Carolina; Glenwood Cottage, Tennessee; Rougemont and Smithfield, Virginia.
Redout Kalé	59.90	Perpignan, in France; Chapel Hill, North Carolina; Portsmouth, Virginia; Sacramento, California.
Simphéropol	75.88	Santa Cruz, in Teneriffe; Puerto Principe, Cuba.

It may further be remarked that while the southern parts of European Russia suffer intolerably from the prolonged effects of the sun, and a due want of humidity in the atmosphere, which produce extended droughts, the other positions of the empire are often subject to sudden fluctuations of temperature, violent storms of wind, hail, and snow, as well as to late vernal and early autumnal frosts.

The following table shows the number of consecutive days in a year, in various parts of Russia, without frost:

Places.	Days.	From—
Wologda	37	July 5 to August 12.
Saratow	45	June 9 to July 24.
Mohilew	62	June 14 to August 15.
Riga	71	May 31 to August 10.
Kiew	153	March 28 to November 4.

Upon an average, at St. Petersburgh, 230 days of the year are reckoned as winter, 160 of which, that is, from the 27th of November, till the 19th of April, the Neva is bound in ice. In winter the east wind prevails for 113 days, and that from the west, 68 days. In summer the westerly winds blow 110 days, and the easterly, 84 days. In the course of a year there are 131 foggy days,

while at Moscow there are 31, and at Oufa only 9 days. Snow and ice often appear at St. Petersburgh by the 10th of October, and continue until the beginning of May.

The following table shows the depth of rain and snow falling in a year, in European Russia, expressed in English inches:

Places.	Rain.	Snow.
Uléaburg	.....	77
Vasa	.....	123
Albo	23.7	146
Helsingfor	17.9	.....
St. Petersburgh	17.9	151
Revel	18.4	130
Riga	24.1	146
Mitau	22.6	145
Warsaw	19.5	153
Kicheneff	15.8	74
Odessa	13.9	92
Simpheropol	14.8	101
Sebastopol	7.7	.....
Koutaïs	56.5	.....
Tiflis	20.6	.....
Chamacha	13.7	.....
Derben	16.1	.....
Astrakhan	4.1	75
Orenburg	13.7	120
Oufa	.....	110
Archangel	.....	176
Petrozawodsk	.....	113
Witebsk	.....	213
Moscow	27.0	159
Wologda	17.6	121
Vladimir	.....	119
Kazan	14.6	90
Minsk	18.3	132
Orel	24.7	120
Koursk	17.8	154
Kharkow	21.8	134
Saratow	.....	92
Woronèje	16.8	85
Ekatherinoslaw	19.5	75
Kiew	.....	121
Mohilew	18.3	132
Pottawa	.....	92
Novotcherkask	13.8	96

The following phenomena connected with the climate of Russia, as compared with similar occurrences in other countries, are particularly worthy of note:

The winds most injurious to agriculture in the central part of the empire are those blowing from the north, which cause sudden and excessive cold. On the

contrary, those from the southeast, in the southern provinces, are followed by extreme drought.

Thus in December, 1839, the cold was so severe in Tambow during a north wind, that the apple trees, which had borne fruit for twenty years, were all killed and the culture abandoned.

The same winter the Cossacks lost by the cold, for the want of shelter and forage, more than 93,000 head of domestic animals of various kinds.

We find it recorded that at St. Petersburgh, in 1732, the thermometer stood at 32° F. below zero, and at Tornéa at 37° below.

On the 12th of October, 1809, mercury congealed at Moscow, assuming the malleable form, which indicated a temperature of 40° below zero, Centigrade and Fahrenheit, the scales of the two instruments at this point being the same.

In the vicinity of Odessa, on the other hand, the earth sometimes becomes so much parched up from the effects of the southeast winds, that the leaves of the trees turn yellow and fall by the end of June.

Among the curious details recorded by M. Koialwicz concerning the winters of 1414 and 1492, it appears that in the 55th parallel of latitude, in Poland, in the month of January, the birds built their nests, green wheat was in the ear, cabbages had formed heads, and the fields presented an abundance of flowers. But in the month following all of this rich precocity was destroyed in a single night by the intense cold.

At Dantzic, near the end of October, 1568, the common rose bushes put forth their second crop of flowers. The same phenomenon occurred there again in 1588.

At Samara, on the Volga, there occurred a drought in 1835 of 57 days, by which most of the crops were parched to the ground.

In the government of Kherson, in the winter of 1832–'33, it snowed on 45 consecutive days—from the 11th of December to January 14; and in 1837–'38 it snowed on 75 days—from November 29 to February 12. In the winter of 1840–'41, there were 98 snowy days, the prevailing winds being from the east and northeast.

On the 21st of June, 1835, the sky was overcast at Kazan by a dry fog, of a smoky odor, which appeared to extend to Ekatherinoslaw on the 25th of that month, and to Kawnos on the 27th, passing over an area of 26,000 geographical miles in six days.

In the winter of 1827–'28 an awful tempest broke out in the government of Saratow, by which in a single night there perished 1,375,950 animals, namely: 280,000 horses, 10,500 goats, 73,450 horned cattle, 1,012,000 sheep.

At midday on the 6th of June, 1849, there occurred a furious tempest at Pskow; at one o'clock it reached Kalouga; between five and six, Tchernigow and Kiew, extending over a space of about 15,000 geographical square miles.

As to the occurrence of hail storms, there are 47 in a year at Sebastopol and only three in the central part of Russia, while the annual average in the west of Europe is 32.

These occurrences have been cited in order to show that the cosmical laws which operate against the Russian agriculturist are far more formidable than those of any other country in Europe or even in Canada or the United States. Aside from the wide range of temperature referred to above, the sudden purturbations of the atmosphere, manifested in violent winds and storms, and often great dearth of rain in various parts, the comparative shortness of the growing season, caused by late vernal and early autumnal frosts, restrict the production of crops sown in the spring to a period within 37 and 153 days, and all field labor must necessarily be performed in four or five months; whereas the growing season in Canada and the United States ranges within 83 and 365 days; in Belgium, it is 223 days; and in Ireland, 153 days. Again, the field operations in Canada are extended through a period of six or seven months; in Germany and Bel-

gium, seven or eight months; in Ireland, ten or eleven months; and in many parts of the United States to every month in the year.

An anomaly exists, however, between a great part of Russia and Belgium, as well as other countries, which may not appear irrelevant to the subject. At Brussels there are eighteen species of trees which are in full leaf in spring 40 days earlier than the same species put forth at the farm of "Nikolaïef," in the government of Woronèje, situated in the same latitude as Brussels, in the centre of Russia; but these trees at Nikolaïef shed their leaves in autumn 26 days before the same species do at Brussels, thus making their vitality 66 days longer in Belgium than in Woronèje. And what is more remarkable and useful to know, is, that although the leaves on the trees appear 40 days earlier at Brussels than at the farm of Nikolaïef, they flower there only 27 days earlier; and the periods of maturity of the cereals are 11 days later in Belgium than they are in Woronèje.

CULTURE AND PREPARATION OF FLAX IN RUSSIA.

The systems of culture in Russia, in general, are very imperfect, the crops varying according to the soil and climate and the requirements and habits of the people. With the exception of the provinces of the Baltic and Lithuania, and perhaps some other places where alternate rotation is adopted to a limited extent, the farmers and peasants are adverse to innovations of all kinds, and the husbandry may be considered at a low ebb. The two dominant methods are what may be called the "free" or random system, much in vogue at the north, in the governments of Olonetz, Archangel, and Wologda, and the "triennial" or three-field course, notable throughout the central parts. The former resembles in many respects the custom prevalent in some parts of the United States, of abstracting most of the fertilizing matter from the soil by continued culture with the same kind of crops, without regard to rotation or the addition of amendments or manure; and when the land becomes thus exhausted, it is abandoned to the growth of weeds and thorns.

The "triennial system" comprises two classes of crops: those sown in summer or spring and harvested the same year, as spring wheat, spring rye, barley, millet, buckwheat, hemp, flax, peas, poppies, broom-corn, and oats; and those sown in autumn and harvested the following year, as winter wheat and winter rye. The latter are usually sown on a fallow, which, owing to the shortness of the summer in most parts of the empire, can be of but little benefit either to the land or to the succeeding crops. In fact, the whole system is pernicious and needs a radical reform.

With the exception of some of the farms and establishments which receive public encouragement or are conducted by private enterprise, Russia is wofully behind the age in respect to agricultural implements and tools, as well as in their systems of culture. In most of the governments the rude *arare*, or ancient Egyptian plough, is in general use. In the Ukraine they reap their grain with the large German sickle; in other parts, with more consistency, they employ the Belgian *sape*, or Hainault scythe. It should be remembered, however, in justice to the more intelligent class of farmers of the empire, that, within the last twelve or fifteen years, the most approved British and American ploughs, harrows, scarifiers, reaping, threshing, and separating machines, hay-rakes, straw-cutters, churns, &c., have been introduced among them, and may be had at reasonable prices at Viborg-Storona, at the government agricultural school of the Apanages, as well as at Riga, St. Petersburgh, Moscow, and elsewhere.

In a country so primitive in its habits, with a people generally prejudiced against improvements and innovations of all kinds, we are naturally led to expect that their system of flax culture would correspond with the rest of their systems. And such is found to be the case Except the provinces of the Baltic

and in other parts of the empire where the Dutch and Belgian methods are pursued by the more intelligent and enterprising farmers, the culture and preparation of the fibre are of the rudest and of the most careless kind. The ground is barely scratched over with their ancient plough; the seed is sown or scattered in unequal proportions, and as unequally covered; and the whole left for nature to do the rest. At maturity, or later, the flax is pulled, without regard to sorting; the seed imperfectly beaten out, or not separated from the capsules at all; and, for the want of streams or other natural "routoirs," the straw is improperly rotted in stagnant pools or pits dug in the yards of their *isbas*, or is spread on the pastures and fields, where it is exposed for weeks to the sun and rain, until it is quite or half ruined. The secondary operations in the preparation, breaking, scutching, &c., are as unskilfully performed; and when the fibre is disposed of in market, the consequent results of their labor are often a recompense of only half price. The spinning also is generally very much in the background as compared with that of other countries, being performed by hand, with the old-fashioned wheel and distaff; and the hackling is done with a kind of coarse brush, in which are inserted hogs' bristles instead of gills of steel. The looms are of the most primitive form, and the lightness of their construction operates unfavorably against the quality of the cloth.

SORTING, PACKING, AND CONVEYANCE TO MARKET OF FLAX IN RUSSIA.

Although flax may be said to flourish in Russia almost without the aid of man, and were the usual care bestowed upon its culture and preparation, as practiced in other countries of Europe, the fibre, in many parts of the empire, would scarcely be excelled. At present, however, in point of quality, it generally stands in the markets at the lowest grade. The two qualities most esteemed are those called vâsnikov and karelia, distinguished for their remarkably shining or silvery whiteness, and long, soft, smooth, and clean fibre, when dressed. Besides these two classes, the scutched flax is divided into three other sorts, namely:

1st quality, or 12-heads Novgorods;
2d quality, or 9-heads Novgorods;
3d quality, or 6-heads Novgorods.

These terms take their names from the manner of putting up the flax for shipment, each quality being determined by the number of "heads," or parcels contained in a bundle. For instance, a 12-*head Novgorod*, which usually weighs about three poods, (108 pounds avoirdupois,) consists of twelve different parcels bound together in such a manner that the quality of each parcel can readily be determined at the top of the bundle. A 9-*head Novgorod* consists of nine different parcels, and weighs about two and a quarter poods, (81 pounds;) a 6-*head Novgorod* consists of six parcels, and weighs about one and a half pood, (54 pounds.) The latter class is chiefly retained in the country for domestic consumption.

The "tow," or that part of the flax which falls off as waste in the process of hackling, is called codilla, and is made up in bundles of a pood each, weighing about 36 pounds.

The flax which comes from the interior beyond Moscow, is brought down by water to Lake Ladoga, in spring and summer, carelessly packed in barques or large flatboats, whence it is conveyed to the capital through the Neva and the Schlusselburg canal. Considerable quantities are also transported to St. Petersburgh from Moscow and Pskow, on the Nicolas and Dunaburg railways. That shipped from Riga, though less in quantity than that from St. Petersburgh, since the opening of the railways, receives special attention in sorting, bundling, &c., and usually commands a higher price.

On the arrival of the flax at the ports of shipment, it is immediately conveyed to a warehouse called ambare, specially provided for its reception, where it is

speedily assorted under the eye of the government, and is made up into bundles as described above. In the shipment great care is taken to do it, if practicable, in fine dry weather; for if a cargo were compressed into the hold of a vessel, as is usually the case, in a damp or wet condition, it would soon heat and spoil. To obviate this, each vessel is provided with mats, which are spread over the flax in damp weather, in order to keep it dry.

The chief sales take place at the ports of shipment from May into August, as the flax then sold for the foreign markets is in the greatest demand. In the month of September most of the flax merchants retire to the interior to make fresh purchases, as at that period the crops are usually harvested or mature.

The *flax-seed* of Riga, when properly cultivated and saved, is of superior quality, and has long been in great request for sowing in other parts of Europe, and sometimes has commanded almost fabulous prices, which has often induced greedy dealers to adulterate it with seed too old or over dried, or with that half ripened or imperfectly cured from districts far interior. At present there are no infallible signs by which these frauds can be detected when artfully perpetrated, except by actual trial.

Riga flax-seed, designed for sowing, is usually shipped in barrels holding three and a half bushels each, and weighing about 200 pounds, exclusive of the cask. The sales are generally made as early as September.

The chief inland ports in Russia for the shipment of flax are Wilna, Raboun, Witebsk, Porechiê, Beloïé, and Gjatzk; those for foreign commerce are St. Petersburgh, Riga, Archangel, Narva, Pernau, Revel, Libau, and the ports of the Black sea. A limited outlet is also made through the Prussian ports of Kœnigsberg, Memel, and Pillau.

COMMERCE OF RUSSIA IN FLAX.

FOREIGN EXPORTS.

The exports of the products of the flax plant from Russia are indicated in the following tables for the years as therein set down:

Exports of scutched or dressed flax, tow, and codilla to all countries from Russia, within the six following years:

Years.	*Tons.*
1849	85, 745
1850	69, 430
1851	48, 656
1858	72, 974
1859	70, 423
1860	72, 901

From five-eighths to three-fourths of the above-named quantities, it is estimated, were shipped to Great Britain and Ireland.

Exports of flax fibre, tow, and codilla shipped from Russia to the United Kingdom, at decennial periods, from 1800 *to* 1860.

Years.	*Tons.*
1801	9, 405
1810	23, 805
1820	15, 774
1830	35, 179
1840	43, 520
1850	62, 038
1859	58, 365

Exports of flax fibre, tow, and codilla shipped to all parts from St. Petersburg and Riga, for the five years preceding 1853.

Years.	Riga.	St. Petersburg.
	Tons.	*Tons.*
1848	34, 188	12, 886
1849	45, 336	14, 157
1850	38, 636	12, 017
1851	27, 529	7, 078
1852	33, 387	10, 977

The prices of scutched flax, of fair qualities, from Riga, have ranged, for the last twenty years, from £30 to £50 per ton of 2,240 pounds.

Exports of flax-seed or linseed to all countries from Russia, within the five following years:

Years.	*Bushels.*
1850	6, 370, 519
1853	9, 727, 011
1858	7, 180, 391
1859	8, 475, 603
1860	9, 771, 666

The amount of flax-seed for sowing, exported from Riga to all parts in 1850, was 126,518 barrels, of which 56,179 barrels were shipped to Great Britain and Ireland.

Exports of flax-seed for sowing, shipped from Riga during the season of 1859–'60, *to various countries.*

Countries.	*Barrels.*
Belgium	66, 604
France	30, 089
Ireland	35, 871
Rotterdam	3, 059
Lubeck	21, 542
Stettin	17, 471
Total	174, 636

The prices of Riga flax-seed, within the last twenty years, have ranged from 35 shillings sterling to 53 shillings per barrel of 3½ bushels; or about $2 50 to $3' 75 a bushel in the United States.

FLAX IN THE UNITED KINGDOM OF GREAT BRITAIN AND IRELAND.

In a country like Great Britain, with her immense, almost incalculable wealth, her gigantic manufacturing power, rich mineral productions, extensive fisheries, widely spread maritime commerce, and her unrivalled facilities for intercommunication, guided by a keen-minded population, it would be natural to suppose that she would stand pre-eminent in the industry, trade, and commerce of flax and its products. But to dwell on this subject at length, and to enter into all its processes and ramifications in detail, would be to write volumes. The present object, therefore, will be better answered by noting the more prominent and well-authenticated facts connected with, and the results achieved by, this portion of the *vis vitæ* of the two islands under their respective heads.

FLAX IN IRELAND.

In viewing a country like Ireland, apparently a land of anomalies and contradictions, whether we consider it in its present or past, one might be surprised to find that it excelled all other countries in the production and manufacture of linen, and that it lies within the scope of its resources, if fully developed, to supply therewith the demands of the civilized globe. With a soil of remarkable fertility, millions of acres of which lie almost in a state of nature, and a climate sufficiently mild, cool, and moist for a period of half the year to perfect the growth of flax, which, in connexion with its numerous lakes, rivers, and lesser streams, affords ample facilities for the preparation and conversion of its fibre into cloth, for bleaching the same after it is wrought, and with the best of harbors for its shipment to all parts of the world. This picture will appear still more strange when it is asserted that, with all these facilities, while the island is advancing, the people, in general, are retrograding, the country growing richer, and the inhabitants becoming more and more poor, the soil, on the one hand, yielding an abundance of almost everything constituting the nation's wealth; and on the other, a population by whose toil that abundance is produced, subsisting on the lowest quality of food, a great portion of the land wanting labor, and a great portion of the labor wanting employment, the export of food increasing with an increase of destitution; and to these anomalies may be added another, most influential in its social effects, the Irishman's love of saving money, without system, on the one hand, even to miserly penuriousness, and the pleasure of spending it, without forethought, on the other, in extravagance and prodigality to excess. These conflicting elements in the character of this people may be attributed more to their origin, isolated position, degree of interest they possess in the soil or in the industry of the country, than to their existing politics and religions. They consist of a medley, made up, in general, from the descendants of various adventurers, who had either come to the island for refuge or for the purposes of conquest, at different periods, comprised of parts not less heterogeneous than the modern inhabitants of Great Britain and of the United States, being a mass of aboriginal Irish, Milesians, or Spaniards, Danes, Saxons, Normans, Picts, Scots, English, (Quakers, Methodists, Puritans, and other Dissenters,) Huguenots, and Palantines, or Germans.

To those who have studied and accurately noted the diversity of habits and employment of this paradoxical people, it is apparent that the most intelligent and enterprising portions have descended from entirely different races or stocks from those who are addicted to alternate activity and indolence, and who have no ostensible interest in the soil beyond the payment of their rent, and the annual procurement of a scanty supply of fuel, clothing, and a low order of food. To alter a state of things so inveterate, so unfortunately entailed upon this class of beings, can only be mitigated by training them to a better condition, and

affording them an opportunity to advance in the scale of comfort and respectability, the practicability of which has been most conclusively proved in numberless instances by those who have emigrated to America and other distant lands.

Sir Robert Kane, in alluding to the almost exclusiveness of the linen manufacture in the north of Ireland, in his "Industrial Resources," says: "It does not arise from any physical circumstances of soil or climate, or from the greater facilities of access to mechanical power; on the contrary, the soil of Ulster, if we except the valley of the Lagau, and some scattered districts, is not, by any means, equal to the soils of the south and centre. The growth of this department of industry in Ulster is owing rather to moral causes. Its population was, essentially, of a class devoted to industrial pursuits, and eager after the independence and power which pecuniary success confers, and which was within their reach; whilst the south, the wretched remnants of feudal barbarism, paralyzed all tendency to improve. The lord was above industry, the slave was below it; and hence, although the circumstances of a fertile soil, easy access to markets, and abundance of motive power, were, in themselves, favorable, the blessings which nature presented were left unutilized by the ignorance and inertness of the people."

The same respectable authority demonstrated from reliable data that the 36 inches of rain which annually fell upon Ireland, if economically compensated for, the river Shannon alone, between Limerick and Lough Allan, would afford a continuous force of 38,667 horse power; and that the available water power of the whole island, exclusive of tide power, would represent 3,533,565 horse power, a mechanical force, night and day, sufficient for the development of any possible amount of industry Ireland could require, and on the grandest scale.

Again, from official returns, within her 750 miles of deeply-indented coast, Ireland possesses some of the noblest harbors in the world, fourteen of which would admit the largest ships-of-war, seventeen sufficiently deep for frigates, and thirty-six for coasting vessels, besides twenty-four good summer roadsteads, found in various parts; thus offering greater facilities for maritime commerce, perhaps, than any country of equal extent on the globe.

The undeveloped resources of her agricultural capabilities, considering the density of the population, (388 persons to each square mile of arable land,) would seem almost incredible. From actual surveys, it has been ascertained that Ireland contains upwards of 14,000,000 acres of tillable soil, a large portion of which lies in pasture, or nearly in a state of nature. If this area were properly improved and subjected to a judicious system of assolement and rotation of crops, one-twelfth of which might be flax, the breadth of culture of this product might be extended to 1,000,000 acres per annum, yielding, on an average, 250,000 tons of scutched fibre, an amount nearly equal to the entire flax crops cultivated at present on the globe, or equivalent to 1,250,000 bales of the best Sea Island cotton, either in value or effective use.

HISTORY AND PROGRESS OF FLAX CULTURE IN IRELAND.

The introduction of flax culture into Ireland is said to have been by the Romans, and, according to some accounts, more remotely, by the Phœnicians; but these traditions are not confirmed by any certain records under modern control. The introduction by the Romans is strengthened from the fact that the name of flax in the Irish vernacular is *lhin*, a term probably corrupted from *Linum*, the Latin name of the plant. Whence *lin* in French, and *lino* in Spanish, both of which are purely Romanesque names.

The earliest mention of linen as occurring in Ireland was in A. D. 500, as quoted by McPherson, (*Patricii Synod.*, can. 9; *Cogitos*, c. 11; *Adamn.*, iii, c. 26,) in his Annals of Commerce: "The bodies of the dead, at least those of eminent rank, were wrapped in fine linen." But it is not stated whether it was

the product of the island, or was imported among other articles of sumptuous dress.

Three or four centuries later we find that, when the native kings diverted themselves in warring against each other by way of practice, the linen *cota* formed a conspicuous article in the dress of the people of various ranks.

Towards the close of the fourteenth century linen was well known as a staple product of Erin, and "breeches of linen cloth" were caused to be made for the four kings.

In about the year 1430, Joannes Hakluytt, who had travelled through Ireland, states that the commodities of that island were linen, wool, fish of various kinds, hides, and the skins of wild beasts.

In the reign of Henry VIII, in 1509, the "wild Irish," it is stated, had such plenty of linen cloth as to wear thirty or forty ells in a shirt, gathered and wrinkled, and washed with saffron, because they never took off a garment of this sort before it was worn out. Noblemen, however, were allowed more than twenty cubits or bundles of linen in a shirt, which was not dyed.

The foundation of the linen manufacture in Ireland was laid by the Earl of Stafford, in 1639–'49, the time he resided in that country as its chief governor. He sent to Holland for flax-seed and to the Netherlands and France for competent workmen, under the belief that linen could be produced twenty per cent. cheaper in Ireland than in other countries. The seed was sown and succeeded, according to expectation; spinning-wheels and looms were set to work; and, in order to animate others by his example, the earl embarked in the business himself, and attempted to make a complete personal monopoly of the enterprise, expending £30,000 for its promotion from his private fortune. Not content with this movement, his lordship issued an arbitrary edict to the effect that any farmer, weaver, or linen-draper who manufactured flax fibre by any other mode except that which he prescribed should be punished by severe penalties, both in respect to personal liberty and to property. His proclamation commanded that flax should be worked into thread and yarn "by ways in which the people were unskilled." Every case that could be discovered where this arbitrary law had not been obeyed to the letter was punished by the forfeiture of the flax or its products and the levying of fines or the imprisonment of the offenders. Notwithstanding most of those who contravened his act had no means provided for teaching them to work according to the new system, they were often ejected from their dwellings into the roads, their children turned into the fields to eat grass with the beasts, and hundreds lay down and died by their side, altogether about one thousand individuals perishing by this cruel edict.

From the fruitful results of these proceedings it is gratifying to state that, as an atonement for the vast evils thus brought about, in the year 1641 the town of Manchester, in England, purchased linen yarn from the Irish in considerable quantities, and, after weaving the same, sold the cloth to them in return, which, it has been asserted, gave the first impulse towards the linen manufactures of the present United Kingdom. At this stage of the linen trade the width of the webs was usually twelve but never more than eighteen inches. Stafford had fifty looms at work, and the total value of the cloth then manufactured on the island did not exceed £1,700 a year.

After the accession of Charles II, in 1661, quite a different policy was pursued in relation to Ireland's chief staple. Laws were enacted for the encouragement of flax culture, and premiums offered for the finest 36-yard webs, exhibitions being held once in six months, and £10 awarded to the producer of the best article, £6 for the second best, and £4 for the third. At this period the total value of linens annually exported from the island amounted only to about £6,000, while the exports of woollen goods, which were then largely manufactured, averaged £110,000 a year, being the true and natural staple of the Irish, their climate and extensive sheep-grounds insuring to them a steady and cheap supply of the raw material, much beyond their domestic wants.

From 1664 to 1668 James Butler, the first Duke of Ormonde, in order to supply new occupations for the displaced capital and industry of the country, upon recovering his estates in Ireland distinguished himself in reviving the industry and trade which had previously been encouraged by Stafford. He despatched persons into the Low Countries to learn the methods practiced and the regulations observed there, inviting over from Brabant and other parts a considerable number of experienced hands. One body of these industrious emigrants amounted to five hundred. Some of them were located at Chapel Irod, in Kilkenny, under Colonel Richard Lawrence, where houses were built for the weavers, and a considerable trade in cordage, sail-cloth, and linen grew up.

About this time, as the British Parliament had passed an act prohibiting the importation of Irish cattle into England as a nuisance, Ormonde, being advised that there was a favorable opening for a foreign woollen trade from Ireland, settled large colonies of woollen weavers (Protestant Walloons) at Clonmel, Kilkenny, and Carrick-on-Suir. By this movement and other encouragements the trade flourished in process of time, but its prosperity belonged to a later date.

In 1670 linen manufactures were liberally encouraged among the Scotch in the north of Ireland, where it became a great object, and has so continued ever since.

In 1681, and subsequent, the culture of the flax plant and the labors connected with the distaff and the loom were regarded as the special privilege of the higher class of farmers, their wives and daughters. Sir William Temple, who wrote about this period, says: "No women are apter to spin linen thread well than the Irish, who, laboring little in any kind with their hands, have their fingers more supple and soft than other women of the poorer condition with us." "And besides," continues he, "what has been said of flax-spinning, the soil and climate are proper for whitening both by the frequent brooks and also winds."

To revert again to the woollen manufactures, an act under Charles II, in 1659, prohibited generally the export of wool either from Great Britain or Ireland to foreign countries, though it was admitted into certain ports in England from Ireland on the payment of a duty of 15 pence on a stone of 18 pounds. On this footing, it is believed, the laws in these respects stood until the year 1698, when, with "a view to secure the woollen manufacture as much as possible entire to England," both houses of the British Parliament addressed William III, "to use his utmost diligence to hinder the exportation of wool from Ireland, except to be imported hither, for discouraging the woollen and encouraging the linen manufactures." His Majesty thus replied to the House of Commons: "*I shall do all that in me lies to discourage the woollen manufacture in Ireland, and encourage the linen manufacture there*, and to promote the trade of England;" upon which an act was immediately passed, with the approval of the Irish Parliament, prohibiting the export of wool, woollen yarn, new and old drapery, from Ireland to any place other than England, on pain of confiscation, imprisonment, and transportation. The privilege of exporting these articles to England, however, does not appear to have been fraught with much advantage, for manufactured woollens were still subject to high duties imposed by the act of Charles II, in 1659, which amounted nearly to prohibition; and the Irish Parliament, not content with those duties, imposed an additional tax of four shillings on a pound, *ad valorem*, on the exportation of all old drapery, (except fringe,) and two shillings on a pound on all new drapery.

Under this code of laws, England effectually restrained the Irish woollen manufactures, except those of home consumption, as well as the export of Irish wool; and thus matters remained until the year 1779, when these acts were repealed or amended. The consequence was, Ireland exported no manufactured

wool, but worked up all she had; and there was but little reason to suppose the quantity would be increased, as a change in her agriculture and the extension of her linen manufacture gave a better profit to the land than could be realized, under the circumstances, by rearing sheep. In 1698, at the time of the passage of the act referred to above, the exports of woollen goods from Ireland amounted to £110,207; in 1798, they had fallen off to £12,500; and for many years since this trade has been comparatively insignificant.

It may here be observed that the lord justices of Ireland, in their speech to the Irish Parliament in 1698, say: "Amongst those bills there is one for the encouragement of the linen and hempen manufactures. At our first meeting we recommended to you that matter, and we have now endeavored to render that bill practicable and useful for that effect, and, as such, we now recommend it to you. The settlement of this manufacture will contribute much to people the country, and will be found much more advantageous to this kingdom than the woollen manufactures, which, being the settled staple trade of England, can never be encouraged here for that purpose; *whereas the linen and hempen manufactures will not only be encouraged as consistent with the trade of England, but will render the trade of this kingdom both useful and necessary to England.*" The House of Commons (Irish) replied: "We pray leave to assure your excellencies that we shall heartily endeavor to establish a linen and hempen manufacture here, and to render the same useful to England as well as advantageous to this kingdom; and we hope to find such a *temperament* in respect to the woollen trade here, that the same may not be injurious to England."

In pursuance of this answer, they evinced that *temperament* most effectually by passing an act for laying prohibitory duties on the *export of their own woollen manufacture*, thus accepting the *national compact*, and fully performing their part of the agreement, and by that performance giving an incontrovertible claim to Ireland upon England, and consequently upon Great Britain, for a perpetual encouragement of the linen manufacture, "*to all the advantage and profit that Ireland should at any time be capable of.*"

Thus it will be seen that the linen manufacture in Ireland for centuries was continued under a forced and uncertain prosperity; and it was not until about the year 1690 (when Louis Crommelin, a native of St. Quentin, in France, who, on the revocation of the edict of Nantes, five years before, fled to Holland, whence he emigrated, with thousands of other Protestant Huguenots, to England, and finally settled at Lisnegarvey, now Lisburn, in the county of Antrim) that this branch of industry was permanently established. Crommelin was a gentleman of remarkable genius, of great energy, the descendant of linen manufacturers who, for upwards of five hundred years, had been the hereditary promoters of the textile arts in Picardy. He had been engaged himself in the business more than thirty years. On his settlement at Lisnegarvey, with a steadiness of purpose which formed so important an ingredient in his character, he at once became the leader of his brother exiles, rewarding their toil and cheering their efforts with all that a liberal heart and a well-stocked purse could bestow.

At this period the Irish "spinning-wheel," though simple in its mechanical arrangement, and had worked wonders in the early stages of the linen manufacture, had a defect in having separate cords or strings passing round the rim, one going round the whirl of the spindle and the other round the whirl of the spool. By this means the spindle and the spool moved at the same time, and nearly at the same velocity, which, when in operation, overtwisted the thread and yarn. The linen loom, also, then used in Ireland, was of a very rude construction, and, in fact, as a machine, was equally ineffectual in its operations as the wheel. Through the instrumentality of Crommelin, these difficulties were overcome by the introduction of improved spinning-wheels, looms, reeds, and flax implements of approved structure, which enabled the Irish manufacturers

to produce a fabric of finer texture, and more likely to command a wider market, than had hitherto been the case; and as it was the policy of William III, the reigning monarch at that time, to assist this exiled colony by public grants, in order that they should devote themselves effectually to the increase and improvement of the linen industry, it may be safely assumed that this era was the grand starting point of the manufacture in Ireland, and of the successful cultivation of the raw material. Rapid, indeed, was the advancement of every branch of the manufacture under the direction of the Huguenot chief, from the labors of sowing, cultivating, and preparing the flax, through all the phases of its manipulations to the finishing point of the cloth at the bleach-fields.

Among other achievements, Crommelin wrote and caused to be published, at Dublin, in 1705, "An Essay towards the Improving of the Hempen and Flaxen Manufactures in the Kingdom of Ireland." From this essay copious extracts are inserted in a subsequent part of this Report, so far as it relates to the cultivation of flax and rotting its fibre, which, with the exception of those who strictly adhere to the "Courtrai system," is the prevailing method practiced in Ireland at the present day.

During the reign of William III, he kept a watchful and encouraging eye on those subjects directly connected with the improvements of the kingdom; and only a short time before his death a patent was issued, granting £800 a year, for twelve years, to Crommelin, whom he had appointed as overseer of the Royal Linen Manufactures of Ireland, as an interest of eight per cent. for the capital he had invested from his own private means to carry into execution his plans. In addition to this grant, there were also allowed to Crommelin £200 a year, as an annuity, besides £120 to each of three assistants. The duties of these officials were to watch over the cultivation and preparation of flax at one period of the season, and, in the course of the summer, to visit the bleach-fields of the particular districts which had been set apart for each.

In 1696, hemp and flax were admitted into England free of duties, and, in 1704, linen goods were allowed to be carried to any of the British colonies.

The next step of importance in the linen industry was the establishment of a "Board of Trustees of the Linen and Hempen Manufacturers of Ireland," by an act of Parliament, in 1710, in the reign of Queen Anne.* This act was passed with the avowed object of "encouraging the culture of flax, and the improvement of the manufacture of linen;" and a series of laws was framed for their regulation, as well as for the prevention of fraud, which for wisdom, penetration, and minute details, in everything appertaining to the business, would do honor to the most enlightened country in more recent times. Liberal sums were placed at the disposal of this board by the government, varying from £18,000 to £25,000 per annum, to be applied in the shape of premiums for extending and encouraging the growth of flax, as well as for converting its fibre into thread or cloth. Under these auspicious influences, together with the efforts of the "Royal Dublin Society," established in the reign of George II, and, more recently, those of the "Royal Society for the Promotion and Improvement of the Growth of Flax in Ireland," instituted in 1841, as well as those of the local Chambers of Commerce and Boards of Trade, the linen industry increased from year to year up to the present time.

It has been asserted that the linen manufactures of Ireland have gradually been raised to their present flourishing state from the operations of the act of 1743, and subsequent acts, granting bounties from half a penny to a penny and a half on each yard of linen manufactured and exported from that island to Great Britain, and to all parts of the world, until the year 1828, when they were all annulled.

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* This board was abolished in 1828, after absorbing from the national exchequer, for various appropriations, £1,620,000.

These acts, so unwisely instituted and so unjustly pursued for a period of eighty-five years, it appears, did not originate with, nor were they suggested by, the Irish themselves, but, according to the British journals, were the offspring of a petition from London traders and Scotch manufacturers. They were granted in preference to refusing drawbacks on the foreign linen, which was the plan suggested, and in which no benefit to the Irish was contemplated; so far from it, the bounties extended to Irish linen were confined to the property of persons residing in Great Britain till the year 1780, when the subject attracted the attention of the Board of Trade, as they were intended for the London merchant, and to prevent their direct export from Ireland to foreign parts.

In a system so unwisely devised, and so long continued, Great Britain, strange as it may appear, was actually subjected to one of two disadvantages—either to an increase of price on the linen imported from Ireland, equal to about 25 per cent. on its value, which fell on the consumer, or to a proportionate loss of revenue to the realm! On the other hand, Ireland was the loser, in the long run, as the bounties on export, though so long regarded as the main support of their manufacture of coarse fabrics, encouraged the production of extremely low and almost worthless articles, on the value of which the bounty became a handsome profit to the manufacturer; and such goods, of course, were despised when brought into comparison with those of the continent in distant markets. The consequence was, a great reaction took place, and the home as well as the foreign trade very seriously fell off. Frauds to an immense extent were discovered by the bleachers and also by the purchasers of "white goods." Inferior descriptions of cloth, short measure, and damaged portions of the webs, formed grounds of constant complaint; and what is technically called the "lap-yard" (the outside fold, which is first presented to the inspector or buyer) was of superior quality to the body of the web, which was often stinted in the warp, or filled with inferior yarn, and thus purchasers were greatly deceived as to the real value of the goods.

The largest sum paid for bounties on the linen exported in any one year was £44,738, in 1771; and the least sum on record, £384, in the year 1744.

There is one fact, however, in connexion with this subject, which it may be interesting to relate. When bounties were paid upon everything in the shape of linen exported from Ireland, and duties were imposed upon all competing fabrics from abroad, the entire export from the United Kingdom in the year 1830, the time the payment of bounties on linen ceased, fell short of 62,000,000 yards; and in 1860, only thirty years after, when there were no protective duties whatever, and the trade was perfectly free throughout the kingdom, it amounted to nearly 144,000,000 yards of cloth and more than 31,000,000 pounds of linen yarn, besides a large quantity of thread, tape, lace, and other small wares.

Although fostered at its birth and for many years after by bounties, legislative protection, and other extraordinary means, this branch of national industry suffered a violent shock when these dangerous aids were withheld, and it thus became nakedly exposed, in the progress of free trade, to the competition of foreign mills. In Manchester and Glasgow vigorous efforts were made to wrest from Ireland this valuable resource, but they failed of success. From the introduction of labor-saving machinery for dressing flax, washing, rubbing, and beetling linen, in the early part of the last century, and the improvements in bleaching, by means of potash, soda, and sulphuric and hydrochloric acids, towards its close, as well as the adoption of the spinning-mill and power-loom, at the beginning of the present century, all of which have caused immense amounts of capital to be sunk—to which might be added the peculiarities of the climate, so favorable to the growth of flax and to the operations of spinning and bleaching, as well as the fertility and small holdings of the land, so well suited

to the economy and manners of the people—Ireland is triumphant in the production of linen, and can compete with the world.

The breadth of flax culture in Ireland, and the yield of fibre, are indicated in the following table, which will show its progress since the year 1698:

Years.	Acres sown.	Yield in tons.	Years.	Acres sown.	Yield in tons.
1698	3,159	.....	1844	.....	39,611
1726	40,000	.....	1847	58,312	.....
1728	48,595	.....	1848	53,863	.....
1787	20,000	.....	1849	60,314	.....
1810	48,238	.....	1850	91,040	.....
1811	92,365	.....	1851	140,536	.....
1813	52,104	.....	1852	137,008	.....
1816	93,665	.....	1853	174,579	.....
1818	83,312	.....	1854	151,403	35,606
1819	77,755	.....	1855	97,075	22,384¼
1820	91,728	.....	1856	106,311	18,764¼
1821	80,785	.....	1857	97,721	14,475
1822	76,809	11,830	1858	91,646	17,583
1841	.....	25,124	1859	136,316	27,000
1842	.....	28,030	1860	128,240	32,000
1843	.....	36,465			

Up to the middle of the last century the flax industry of Ireland, although superior to that of England or Scotland, was, almost without an exception, merely a rural manufacture, purely domestic in its character, similar to that of the remote parts of Silesia or Russia at the present day. The farmer and his sons not only cultivated the crop, but steeped or rotted the flax and dressed the fibre, while his wife plied the spinning-wheel by the cottage hearth, and her daughters wove the delicate threads in the hand-loom into brown linen, which was carried to the nearest market town and sold to the bleachers or dealers to be finished for the "white warehouse," or its final place for sale.

Previous to the appointment of Crommelin as overseer of the royal linen manufactures of Ireland in about the year 1700, the only acids and alkalies used in the process of bleaching were those contained in the kelp, made of seaweed; lime; impure ashes, made of wood and weeds; and the dung and urine of cows. The *modus operandi* were very imperfect and unscientific at best, which often corroded and destroyed the substance of the yarn, or caused the fabrics made thereof forever afterwards to "cotton" or fret. They also mixed the ashes with the yarn in the vats at the same time that it was bucking, and beetled it on large stones instead of subjecting it, with alternate wringings and washings in pure water, to well-settled leys of different degrees of temperature and of strength. Another process of bleaching was, first to steep the cloth in cow's urine, and then wash it in a tub, a woman trampling it with her feet, and changing the water until it became quite clear. The web was next beaten on a stone, and finally spread out on the grass for some weeks, where it was repeatedly sprinkled with clear water until it was imperfectly bleached.

Soon after the advent of Crommelin and his brother exiles, they adopted the processes of bleaching then practiced in the Low Countries and in France, by repeated buckings with leys made of potash and wood ashes from Russia, and afterwards steeping the cloth in skim-milk, buttermilk, and whey, rendered sour by long standing, alternately rinsed in clear water, and exposed on the grass

for months to the winds and sun, with frequent moistenings by fogs, dews, or rains, and artificially wet, as occasion required, until it was thoroughly bleached. The object of the careful bleacher in those days was not only to impart such a character to the cloth as would recommend it to the buyer, without overdoing or underdoing the process, but to entail a lasting reputation on his establishment, giving to the fabric such a color as would hold, or, what was still better, one that would improve by use. From this era up to the year 1778, when, by the application of science and skill, considerable advance had been made in the rapidity of the process of bleaching and finishing linen, it was thought to be wonderful by the Irish to buy a brown web in May and have it ready for the "white warehouse" at the end of the following July.

In 1764 Dr. Ferguson, of Belfast, received from the linen board a premium of £300 for the successful application of lime in bleaching. In 1770 he introduced the use of sulphuric acid in the process.

In consequence of the discovery of chlorine by Schéèle in 1774, and its application to bleaching by Berthollet in 1785–'88, and which has since been adopted and improved upon by MM. Fontenay, Descroizilles, Grandin, and others, the operation has been so much accelerated that the same articles formerly submitted to a tedious and troublesome process of five or six months can now be rendered perfectly white or clear in the space of a less number of days! The operations, moreover, by the old methods could only be prosecuted during the summer months; whereas by the modern processes the capital invested may be productive and the business carried on throughout the year. Great and important changes have resulted from these improvements since the year 1788. Ireland at that time possessed some two hundred or more "bleach-greens," nearly all of which have been swallowed up by those leviathan establishments which have sprung into existence in the neighborhoods of Belfast, Gilford, Banbridge, and elsewhere, and have been yearly widening the boundaries of their operations by the concentration of capital aided by scientific skill. At one period the county of Armagh could boast of about eighty bleach-fields, and the country about Belfast could count half as many more, all of which have been abandoned, and a few large establishments erected in their stead. Fifty years ago, within a circuit of seven miles of Belfast, there were seventeen bleach-greens in full operation, which, in the aggregate, annually turned out about 200,000 pieces of linen—an amount surpassed at present by a single bleachery, with a capacity to extend its operations to double that quantity, and even more!

It was not until quite at the beginning of the present century that flax spinning-mills were erected in the north of Ireland. Before that time, as remarked in a preceding paragraph, the operation was performed altogether by women on the cottage wheel. For a considerable time the attempts to introduce mechanical spinning were attended with but little success. But, as what is termed "wet spinning"* was one of those improvements in machine-work which manual labor had but little chance of competing with, the old spinning-wheel gradually gave way, and the factory system adopted in its stead.

The first spinning factory driven by motive power in Ireland was erected at Cork in the year 1806, and comprised only 212 spindles. About the same time a small factory was also built at Ballymena, and another at Crumlin. The linen board, by offering a bounty of thirty shillings per spindle, succeeded in causing the establishment of several others, which, in 1809, contained, in the aggregate, 6,369 spindles. In the year 1815, in the province of Ulster, there were five mills, the largest having 1,204 spindles, and the smallest 300;† in

* By this mode of spinning, the fibres of the flax are made to pass through hot water varying in temperature from 190° to 212° F., which so softens them that they can be drawn out, and made to yield thread of much superior quality than when spun dry.

† In the year 1800 Belfast did not possess a single mill.

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Leinster there were two mills, and in Munster seven, only one of which was in operation, owing to the depressed state of trade. In 1835 the whole number of flax-mills on the island was twenty-five, giving employment to 3,681 hands. Six years later we find there were forty-one mills, containing 280,000 spindles. In 1850 the number of mills had increased to sixty-nine, with 396,338 spindles. In 1856 there were one hundred and ten mills, with 567,980 spindles, and about 50,000 hands. Since that period the number of mills has still increased, representing an immense amount of capital, invested in lands, buildings, machinery, and the necessary facilities for carrying on commercial operations, estimated at more than $20,000,000. One establishment at Belfast alone furnishes employment within its walls to 2,500 hands, and to several thousand without.

As an extraordinary feat in flax-spinning, may be mentioned that performed by Miss Ann Macquillan, of Comber, in the county of Down, in about the year 1815. From a parcel of flax grown in the barony of Castlereagh, she spun, on a common wheel, yarn running up to sixty-four "hanks,"* or 220,400 yards to a pound! She prepared the flax after her own peculiar system, by dividing the fibres with a fine needle. It may be here remarked that no French nor Belgian spinner, far-famed as they are, ever exceeded the degree of fineness in linen yarn as thrown above.

The great extension of flax-spinning in Ireland by motive power gave a new and effective impulse to the manufacture of thread, by increasing the supplies and cheapening the cost of the raw material. From what was formerly a comparatively small trade, this department now assumes a gigantic form, employing a vast amount of capital, and affording occupation to thousands of hands.

The principal firms engaged in the linen thread manufacture in the north of Ireland are those of Messrs. William Barbour & Sons, Robert Stewart & Sons, and Dunbar, McMasters & Co., all of whom have houses at Belfast.

Power-loom weaving, as applied to the manufacture of linen fabrics in Ireland, is of a more recent introduction than mechanical flax-spinning, having been adopted in Great Britain the early part of the present century, previous to which weaving was performed only by hand-looms.

In 1760 there were 400 linen looms at work at Belfast, and, although the business was generally extended to other parts of the island from the period of termination of our war of indepenence, there were only ten looms left in operation in 1798. It was supposed, however, that the introduction of the "fly-shuttle" in about the year 1775 had a tendency to give a greater impulse to linen weaving, as a branch of labor, than any other modern invention. Previous to this new mode of throwing the "weft" from selvage to selvage two persons were required to work a very broad web, one shooting the shuttle from the left side of the loom, and the other from the right.

The number of power-looms in Ireland for weaving linen in 1850 was only fifty-eight. In 1856 there were 1,691, and the number has since been increased to many thousands.

In tracing the progress of the linen manufacture in Ireland down to the year 1828, we find it rather in a backward state. About this period two energetic men, Mulholland, of Belfast, and Murland, of Castlewellan, names as familiar in Ulster as those of Watt and Arkwright in Lancashire, stepped forward, and entered into the business with heart and soul. Both of these active and intelligent minds largely applied their capital to the improved methods of spinning

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* The following table shows the division and contents of a bundle of linen yarn:

		Yards.
1 reel or thread	=	2½
1 lea or cut = 120 threads	=	300
1 hank = 12 leas	=	3,600
1 bundle = 16 hanks and 8 cuts	=	60,000

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and weaving, and laid a basis for the future prosperity of the north of Ireland, and they now receive for their yarns and fabrics a good share of the markets of the world.

By the introduction of improved machinery and the adoption of the best modes of bleaching, the Irish are now enabled to manufacture almost every description of linen, except lace and the finer kinds of cambrics, as well and as cheap, and perhaps of a better quality, than any other country.

Simultaneously with the manufacture of plain linen in Ireland, gradually rose that of "cambrics,"* "lawns," "hemstitched" or "veined" pocket handkerchiefs, &c. As early as the year 1714 we are told that a piece of cambric which obtained a prize was woven near Waringstown and excited the greatest possible curiosity. Its owner carried it about in a tin case, and although the "set" did not exceed a "16-hundred," all who saw this wondrous fabric were delighted and astonished at its fineness.

In about the year 1782 Mrs. Turtle, of Aughagallon, near Lisburn, who was well known for the superiority of her yarns, spun from a parcel of flax, grown in the neighborhood, which was so exceedingly fine and silky that three hanks were passed at once through a gold ring! This yarn was ultimately woven into a piece of cambric of great beauty of texture, and, when bleached and ornamented, it was forwarded to Windsor Castle as a present to Queen Charlotte. Another piece of cambric, still finer than the above named, was sold in the market of Lurgan in 1794. The set of the web is stated to have been a 27-hundred. It was sold for £1 2*s.* 9*d.* per yard.

In 1809 Mr. Atkinson, of Waringstown, manufactured a 28-hundred web, which, in point of beauty and fineness, far excelled anything of the kind that had been previously made in the kingdom. This web was sold in Lurgan market for two guineas a yard, or at the rate of about twenty-eight cents an inch. When bleached it was highly ornamented and sent to London as a present to the Princess Charlotte. In the brown state of this web the warp counted sixty-four hanks to a pound.

But the finest pieces of cambric ever manufactured were exhibited at the "World's Fair," at London, in 1851. One set was a 28-hundred, warp 450 leas, weft 600 leas; another, a 30-hundred, warp 550 leas, weft 750 leas; a third, a 32-hundred, warp 650 leas, weft 850 leas; a fourth, a 36-hundred, warp 750 leas, weft 950 leas; a fifth, a 40-hundred, warp 900 leas, weft 1,100 leas! These goods were all five-eighths bordered handkerchiefs. The last-named set, manufactured by Mr. Henning, of Waringstown, was the finest ever made in the cambric handkerchief department of the trade. The warp of this web was sixteen yards in length, and was so very small and silky in its texture that one could have readily carried it in his pocket; and the whole piece of goods, when woven, was enclosed in an envelope, and thus forwarded by mail from Waringstown to the Seymour Hill bleach-field, from whence, in five days after, it was returned in a finished state!

Coincident with the cambric manufacture grew up those of "sewed muslin," "tambouring," "embroidery," &c., so extensively carried on at present at Belfast, Glasgow, and other parts of the United Kingdom. The history of this trade, which has been the "philosopher's stone" to a large share of the female population of Ireland, and which has conferred vast benefits on the opposite sex, may be traced to the trade in "tamboured goods," and would be interesting in all its details. Every season, whether we consider it in its moral, economic, or merely financial relations, and especially in those times of pressure "when

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* The term *cambric* took its name from the ancient town of Cambrai, in France, where this class of goods was first introduced.

Lawns are a kind of open-worked cambric, formerly chiefly manufactured in Flanders and France.

dearth heralds destitution, and the storms of winter are exceeded by the severities of want," gives new illustrations of the value of industry in one class and enterprise in another. In Ireland, let it be reiterated, it has been one of the greatest boons that could have been conferred in ameliorating the condition of her people, and in giving a higher tone to their habits, on the one hand, and in elevating their taste and acting as a stronger incentive to self-exertion, on the other. In illustration of this, it may be stated that during the great snow-storm in January, 1854, it is well known that the females connected with this manufacture suffered less than any other class of operatives; and where considerable numbers were hard pressed for food and fuel by the stern realities of wretchedness and want, there were manifested an amount of fortitude and a degree of independence almost unparalleled in such days of visitation and consequent distress.

The sewed muslin manufactures, as before remarked, may be said to have originated in the trade of tamboured goods. Although the latter was carried on to a limited extent in the neighborhood of Belfast towards the close of the last century, it did not receive a decided impulse before the year 1803, when an individual by the name of McFerran, of Lambeg, of Scotch descent, went to Paisley to learn the "tambour-stitch," and, on his return, zealously set himself to work to teach the primitive art of textile decoration to the girls of his native village, as well as those of the neighboring towns. Still very little progress was made in the business before 1810, when the firm of Messrs. J. & R. Workman, of Belfast, who had long been connected with the manufacture of plain muslin and gingham goods, commenced the tambour trade, which soon gave a new tone to that branch of business in the larger towns throughout the countries of the north. Designs for each pattern were engraved on blocks of wood somewhat after the manner of the cuts now so extensively used in illustrating books; and those little blocks of wood, after having been glued on a board eight inches wide by sixteen inches long, were placed into the hands of a printer, who, by the ordinary process of preparation for that purpose, stamped the gray muslin, and thus imparted the designs to the goods previous to giving them out to the females to be wrought.

Besides this class of tambouring, which was usually done on light lawns, another and a higher style of work, called the "satin-stitch," was wrought on fine jacconet, from patterns printed as above. The goods thus made were mostly designed for ladies' dresses, and resembled, in some respects, the sewed muslins of the present day.

In about the year 1813 Mr. George Dunn, an enterprising muslin manufacturer, of Lisburn, employed, at his own expense, the services of a lady from Scotland to teach the young girls in that neighborhood, who had but little useful employment, the tambour-stitch. A school for that purpose was established, and for upwards of twelve months they had the benefit of industrial education, free of charge. The result of this benevolent act was to extend, very materially, the benefits of this branch of trade, and hundreds of females found employment, who before had not the means of supplying their daily wants.

In about the year 1828 the embroidery trade was introduced into Donaghadee by a family named Cochrane; and four years later an attempt was made by Mr. Charles Pelling, of Glasgow, to establish the business on an enlarged scale in the counties of Down, Monaghan, and Armagh; but we have no evidence that any special advancement was made in the trade before 1840, except in the improvements in style of workmanship and taste in getting up designs. From about this period industrial schools were opened for teaching girls the art of embroidery, not only throughout the domains of Ulster, but in almost every considerable Irish town, and the sowed muslin trade has been extended to every nook and corner in the land.

It is difficult to estimate the aggregate amount of cash annually circulated in

Ireland by the sewed muslin manufactures, as no reliable data exist by which a correct opinion could be formed. It is certain, however, that the money paid for labor in this trade far exceeds that which is paid to the operatives of all the flax-spinning mills in the realm. In Belfast alone there are full thirty original or branch houses engaged in embroidery, and a single establishment, that of Messrs. Macdonald & Co., circulated in payment for labor of this class, principally performed by industrious females, between the 1st of January, 1854, and the 30th of June, the same year, the sum of $450,000!

In the progress of textile labors in Ireland, the "damask"* and "table linen" trade attracted early attention. In 1730 an individual named John Holden, in the county of Antrim, who had manifested some genius in the remodelling of diaper looms, was provided with money and necessary materials by the linen board to carry out his designs. But what was the extent of his success in this experiment we have no record. It would appear, however, that nothing remarkable was done in this line before the spring of 1766, when Mr. William Coulson became eminent in founding the far-famed damask manufacture at Lisburn. At that time the wonders which have since been achieved in textile elaboration, or rather in the art of weaving pictorial emblems, were almost unknown. At the commencement he had difficulties to contend with of no ordinary kind. Artistic skill, whether in relation to workmanship, patterns, or designs, had not reached a point requisite to demand a class of men suited to the more elaborate departments of this trade. Artists were to be created to make the patterns or designs; mechanics were to be instructed or encouraged to perfect the more abstruse and complicated arrangements of the looms, and weavers and "draw-boys" required training to fit them for their respective duties. As the business progressed, and skilled labor entered more extensively into the general affairs of the workshop, under the special patronage of Lord Hertford, the owner of the soil about Lisburn, at this period, Mr. Coulson's factory became a regular national polytechnic institution, and may be said to have laid the foundation of the present Belfast School of Design.

In the course of time, as mercantile energy gave an increased impulse to manufacturing enterprise, the style of goods which were produced at the Lisburn damask factory became vastly improved, and the skill of the artisans fully kept pace with the growing taste of the age. Pictorial designs were issued from the looms exceeding in beauty the finest works of ancient silk damasks of Syria. The nobles of Great Britain and the princes of the continent, as well as the untitled, but not less wealthy and aristocratic denizens of the New World, felt proud to have their tables covered with the beautiful and unsurpassable Lisburn damasks.

The mechanism connected with the looms for working the royal table linen in those days was truly wonderful. To the uninitiated the sight of a first-class damask loom presented a mass of the most intricate as well as the most extraordinary and elaborate mountings, which required a talent of no common order even to put them into operation, to say nothing of the master-minds necessary to furnish the designs. The working of one of those looms required an amount of manual labor almost incredible. On a table-cloth woven to order for the prince regent, (subsequently George IV,) which was fourteen quarters wide, there were employed twelve men and four boys. "The machinery by which this cloth was wrought," says a cotemporaneous writer, "is of the most complicated description. The loom has five thousand sets of pulleys, and is so

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* *Damask* is a species of wrought linen, some parts of which are raised above the groundwork, representing flowers, fruits, animals, crests, coats-of-arms, mottoes, devices, &c. Its principal use, however, is for table-linen. The term is derived from Damascus, in Syria, where the manufacture of silk damask was first introduced.

Diaper is a flowered linen used for table-cloths, napkins, towels, &c., &c.

wonderful as to preclude the possibility of giving an accurate description, particularly of the method made use of to show a pattern or picture upon a ground where the ground and pattern are equally colorless. Yet, though weft and warp are alike white, the pattern, when worked into cloth, assumes quite a different degree of shade from that of the rest of the web. These patterns are extensive and varied; rich centre-pieces, ornamented with fruits and flowers, are introduced into some, while coats-of-arms, crests, and mottoes form the chief features of others."

Mr. Coulson enjoyed a full share of court favor, being the first manufacturer of damasks in the kingdom who had attempted to work into fabrics armorial devices, national emblems, and heraldic designs; and the success which attended his efforts was especially eminent. From that period up to the present the house which he founded has continued not only to supply the successive rulers of the United Kingdom with its manufactures, but a large share of the nobles or opulent of most countries of the globe.

SOIL AND CLIMATE OF IRELAND, CONSIDERED WITH REFERENCE TO FLAX CULTURE.

Ireland, in the year 1851, according to the official returns, comprised in—

	Acres.
Arable lands	14, 802, 581
Plantations, (trees)	304, 906
Towns	45, 590
Waste and irreclaimable land	631, 210
Uncultivated, (arable)	5, 023, 984
Total area	20, 808, 271

The natural features of the island are peculiar. A great plain, which stretches across from Dublin to Galway, with its numerous branches or vales between the intervening hills, embraces the central counties, and has an elevation throughout its extent of from 200 to 300 feet, the summit levels of the canals traversing it being its greatest heights above the sea, while mountains of moderate elevation lie in various groups, winding from the southern shores along the western coast quite to the Giant's Causeway and Lough of Belfast, at the north. The character of the eastern shores is generally tame, affording but few good harbors, which is strongly contrasted with the bald headlands stretching out into the Atlantic, the rocky islands which stud the western coast, and the deep, land-locked bays, which afford numerous safe and commodious ports. The wild mountain scenery of the counties of the west is diversified by many lakes, which discharge their waters by short, rapid streams, affording ample facilities for motive power; while the drainage of the island is chiefly effected by the Shannon, which, after swelling from a great river into several considerable lakes, finally empties itself by a broad, deep estuary into the sea. A large portion of the great central plain is occupied by the whole of that immense tract of "peat moss," generally known as the Bog of Allan, which, though wet and deep in many parts, is sufficiently elevated and inclined to admit of artificial drainage. But by far the greater portion of this singular plateau is covered with a light yet very fertile soil, which affords naturally excellent pasturage, and, when cultivated, produces good crops. The sides and bases of the mountains, which rarely exceed 2,600 feet in height, though partly occupied by bogs, support vast numbers of cattle and sheep, for which these tracts are admirably adapted, favored as they are during most seasons with a climate of almost unequalled mildness nearly the whole year.

Within the 5,655,194 acres of uncultivated and waste lands are included about 2,833,000 acres, or nearly one-seventh part of the entire surface of the island, of mountains and bogs. Of the latter there are 1,567,000 acres of flat bog and 1,257,000 acres of mountain bog, nearly all of which is capable of reclamation and susceptible of being made available for productive husbandry, if not required as natural repositories of fuel. Of the mountain land, also, comparatively little is beyond agricultural control.

The average elevation of Ireland above sea level is estimated at 450 feet, there being but little ground lying above 600 feet. In fact, there is no district and but few points on the island sufficiently elevated to present thereby serious impediments to ordinary cultivation. Flax, potatoes, and the cereal grains thrive well at a level of 1,200 feet above the sea.

There is one feature in the Irish landscape perhaps more characteristic than any other, namely, the desert-like baldness of the hills, which, robbed of those sylvan beauties that once diversified their flanks and summits, present to every observer a type of desolation. "This barrenness of trees," says Sir Robert Kane, "is of but recent origin. Numerous localities in every part of Ireland derive their names from having been originally embowered in forests. In every district where man's neglect, combined with Nature's rank luxuriance of vegetation, has given occasion to the formation of those bogs for which our country has become a byword, it is found that, immersed in the turf, are quantities of large timber, generally fir, birch, and oak; the former so impregnated with resinous material that a splinter burns like a candle, and is employed as such."

That the island, some centuries ago, was remarkable for the extent of its forests is now only a matter of history. It was once so thickly covered with timber that it received the name of the "Island of Woods." Many causes, according to the authority just quoted, have conspired for their destruction. "In some districts they were extirpated to increase the arable surface; in others, in order to destroy the shelter which bands of outlaws found in their recesses. An extensive export trade in oak was at one time carried on, and two centuries ago the manufacture of iron was in great activity throughout this country, and led to the cutting down, as Boate says, of innumerable trees, in order to prepare charcoal. During all this time no one planted; all sought their immediate profit, and cared not for the future, and the final result has been that, at present, the timber grown in Ireland is not sufficient for those uses to which it specially is adapted; and as fuel, we may consider it never to be employed."

Ireland is described by all travellers or writers who were competent to judge as peculiarly adapted to agriculture, from the general mildness of the climate and the richness of the soil. It may be stated that its surface, geologically considered, exhibits a vast extent of calcareous strata, which, occupying the central parts of the island, are bounded along the sea-coast by groups of mountains or hills, consisting chiefly of primary rocks. These mountains are not made up of strata or rocks of the same mineralogical composition, nor are they even of the same antiquity; but each range or group has its own geological and mineralogical features, as well as peculiarity of structure.

According to Sir Robert Kane, the districts known to be of the most remarkable fertility are in Ulster, about the valley of the Lagan, and in Munster, embracing the "Golden Vale," which stretches from the end of the coal formation, at Cashel, to near Limerick. On inspecting the geological map of Ireland, these districts are found to contain a greater number of different kinds of rock, and a greater variety of minerals, than any other localities. The Lagan flows on a bed of new red sandstone, on one side of which rises the trap district of Antrim, with its underlying chalk and gypsum marls; whilst the clay-slate of Down bounds it on the south, until it is closed by the old red sandstone and mica-slate, the coal formation, and the tertiary clays, all of which occur at the southern extremity of Lough Neagh. The Munster district lies between the sandstone

and clay-slate mountains of Slieve Phelim and the Galtees. The principal rock of the low country is limestone, through which, however, protrude, in various parts, masses of sandstone and of volcanic trap, the western boundary being the shales and grits of the Munster coal fields.

The surface soil of the great central plain is generally only a few inches deep, and overlies a subsoil of limestone gravel, resting on a stratum of lime rock; yet, the soil itself, when long cropped without proper amendments, is almost barren for the want of lime. The gravel comprising the subsoil does not appear to be a disintegration from the subjacent rock, but consists of rounded stones or pebbles, often occurring in heaps known as "eskers," of much purer lime, and seem to have been deposited by the waters of an ancient lake or sea.

Wakefield, who was an extensive agriculturist of long experience in England, and who published an elaborate history of Ireland in 1812, says: "A great portion of the soil of Ireland throws out a luxurious herbage, springing from a calcareous subsoil without any considerable depth. This is one species of the rich soil of Ireland, and is found throughout Roscommon, in some parts of Galway, Clare, and other districts. Some places exhibit the richest loam I ever saw turned up with a plough. This is the case throughout Meath, in particular. Where such soil occurs, its fertility is so conspicuous that it appears as if Nature had determined to counteract the bad effects produced by the clumsy system of its cultivators. On the banks of the Fergus and Shannon the land is of a different kind, but equally productive, though the surface presents the appearance of marsh. These districts are called *caucasses*. The substratum is a blue silt deposited by the sea, which seems to partake of the qualities of the upper stratum; for this land can be injured by no depth of ploughing.

"In the counties of Limerick and Tipperary there is another kind of rich land, consisting of a dark, friable, dry, sandy loam, which, if preserved in a clean state, would throw out corn for several years in succession. It is equally well adapted for grazing and tillage, and I will venture to say seldom experiences a season too wet or a summer too dry. The richness of the land in some of the vales may be accounted for by the deposition of soil carried thither from the upper grounds by the rains."

The luxuriance of the pastures, and the heavy crops of oats which are every year grown in Ireland, even with careless cultivation, attest the extraordinary fertility of the soil; and this is more singular when it is considered that the soil is very thin.

Three specimens of soil were placed into the hands of Sir Robert Kane for chemical examination, as illustrative of the flax lands of Ireland, which were selected from districts where flax had been successfully cultivated.

Irish soil, No. 1, a light brown loam, moderately adherent and absorbent, subjected to quantitative analysis, was found to contain, in 100 parts, the following ingredients:

	Parts.
Silica and siliceous sand	73.72
Oxide of iron	5.51
Alumina	6.65
Basic phosphate of iron	0.06
Carbonate of lime	1.09
Magnesia, alkalies, and sulphuric and muriatic acids	0.32
Organic matter containing nitrogen	4.86
Water	7.57
	99.78

Irish soil, No. 2, a clayey loam, rather more coherent than No. 1, in 100 parts gave of—

	Parts.
Silica and siliceous sand	69.41
Oxide of iron	5.29
Alumina	5.29
Basic phosphate of iron	0.25
Carbonate of lime	0.53
Magnesia, with excessively minute traces of alkalies and sulphuric and muriatic acids	0.25
Organic matter	6.67
Water	11.48
Loss	0.83
	100.00

Irish soil, No. 3, a fine clayey loam, which became stiff and tenacious when wetted, in 100 parts gave of—

	Parts.
Silica and siliceous sand	64.93
Oxide of iron	5.64
Alumina	8.97
Basic phosphate of iron	0.31
Carbonate of lime	1.67
Magnesia, with considerable traces of alkalies and of sulphuric and muriatic acids	0.45
Organic matter, (rich in nitrogen)	9.41
Water	8.62
	100.00

"It is important to remark," says Sir Robert, "that they are all excellent soils, No. 3 being probably the best. They all contain the ingredients required by the most important plants, and in such proportions as admit of their successful cultivation. The organic matter of these soils was in all cases rich in nitrogen; in fact, in each case the soil showed evidence of having been well manured. It is interesting to remark how small, especially in No. 2, was the quantity of carbonate of lime present in the soil, showing clearly that this earth is required but in very small quantity for the flax crop, and that hence it need not, and perhaps we should say should not, be applied in any instance to it as a manure."

Contrasted with the composition of the above-named Irish soils, is given below the analysis of a sample of soil procured for the same chemist from a locality in Belgium celebrated for the excellence of its flax crops.

In 100 parts of this *Belgian soil*, consisting of a fine powder, dark, blackish brown in color, and quite destitute of cohesion or absorbent power, there were of—

	Parts.
Silica and siliceous sand	92.78
Oxide of iron	0.66
Alumina	1.11
Basic phosphate of iron	0.21
Carbonate of lime	0.35
Magnesia, alkalies, and traces of sulphuric and muriatic acids	0.12
Organic matter, (rich in nitrogen)	2.74
Water	2.03
	100.00

This soil, it will be seen on comparing it with the flax soils of Ireland, is a mere sand, which, were it not for the active industry of the Belgian farmers, would be almost absolutely barren. It is evident that rich manure had been added to it, notwithstanding its organic matter is inferior to that of the Irish soils. It probably owes its peculiar adaptation to flax culture from its total want of cohesion, caused by the absence of clay, which readily allows it to be brought into a minute state of division, so essential to the successful growth of this crop.

From intelligent and practical authority it appears that the lands of Ireland may be divided into five classes, in respect to their relative rent values per acre and the proportion of produce in each allowed for rent, as expressed in the following table:

Classes.	Rent per acre.	Proportion of produce allowed for rent.
Arable land, best	20*s.* to 30*s.*	One-fourth.
Arable land, second	10*s.* to 20*s.*	One-sixth.
Arable land, third	Under 10*s.*	One-eighth.
Pasture land	20*s.* to 30*s.*	One-half.
Inferior and mountain pasture		One-third.

Dividing the wheat land into four qualities, the first comprises such crops as would yield 42 bushels, or 2,520 pounds, to the acre; the second, from 28 to 42 bushels; the third, from 23⅓ to 28 bushels; and the fourth, under 23⅓ bushels.

The yield of oats varies from 980 to 2,156 pounds to the acre; barley, or bere, from 1,344 to 2,240 pounds; rye, from 1,960 to 3,080 pounds; potatoes, from 8,680 to 26,040 pounds; turnips, from 12 to 24 tons; parsnips, from 7 to 11 tons; cabbages, from 9 to 19 tons; hay, from 1½ to 2 tons; flax, 4 to 6 cwt. of scutched fibre, and from 6 to 15 bushels of seed; beans, from 24 to 39 bushels; peas, from 18 to 37 bushels to the acre.

The climate of Ireland, with occasional exceptions, may be regarded as the superlative of that uniformity of temperature so characteristic in several countries in western Europe; and, beyond all comparison, in the expanse of the earth of equal polar approach it is the most habitable. Although the mean annual temperature of the island differs only about 1° F., its seasons are much more mild and uniform than those of Great Britain, especially the southern and western parts; yet they differ greatly in regard to coolness and moisture during the warmer months of the year. The southern and western counties are also much milder in winter and spring than those of the north, the difference of which is greater than is explainable by the difference of latitude or any known cosmical laws, unless it be attributed to the ocean winds, which blow from the southwest during a large portion of the year, and are tempered by the Gulf Stream as it approaches the Irish coast. For instance, on the mountains of Kerry, and near the Killarney, the arbutus (*Arbutus unedo*) and some other half-hardy shrubs grow in great perfection, which are not to be met with again, except in sheltered situations, till we reach the south of the Alps. The snow in these parts of the island, except in extreme seasons, seldom lies for any great length of time; and frost rarely continues beyond a few days, and then, except under extraordinary circumstances, it is by no means intense. This mildness and the humidity of the atmosphere produce a luxuriance and rapidity of growth in vegetation to

which no other part of the kingdom can offer a parallel, as appears in a most remarkable degree in the ivy and other evergreens with which the island abounds; and it is to this peculiarity in their climate that the Irish attribute the beautiful verdure of their pastures and fields during the greater part of the year, which, no doubt, suggested the poetical names of the "Emerald Isle" and the "Gem of the Sea." The northern counties, 5° or 6° colder than the southern, have more frost and snow, which is compensated for, in a measure, in having longer days in summer, and generally more fair weather in the course of a year. From their highly northern position, in respect to latitude, as well as their altitude above the sea, the inhabitants near Belfast and the Giant's Causeway, at the summer solstice, are enabled to read at midnight by the vanishing twilight and the returning dawn, which at that season pass from one to the other at that hour of the night.

In most parts of the island the husbandman is enabled to perform field labor in nearly or quite every month of the year; and from this protracted period, accompanied by a due proportion of humidity and mildness of temperature, necessary to promote regularity of growth in the flax plant, its fibre is there brought to great perfection; for, in order to produce a soft, yet strong, pliable, and lustrous staple, when dressed, easily divisible by mechanical means into minute filaments, a slow and regular growth is requisite. On the contrary, where a powerful sun forces the plant too rapidly to maturity, the fibre is indurated, separates with difficulty, and is deficient in that softness and silkiness so characteristic in all good flax.

The climate of Ireland, also, from the great length of its mild season, the general absence of intense, scorching heats of the sun, and the peculiar humidity of the prevailing winds, which are accompanied by constant verdure in the bleach-fields, is eminently favorable to the operations of bleaching; which circumstances have been offered as an explanation why the Irish linen, when brought into use, surpasses all others in preserving its pure whiteness and lustre until it is consumed by wear.

The following table shows the mean annual temperature of various places in Ireland for a series of years:

Places.	Mean.	Places.	Mean.
	° *Fah.*		° *Fah.*
Cork	53.3	Dublin	50.0
Belfast	52.9	Donaghadee	49.6
Cahersiveen	52.3	Portrush	49.1
Castletownsend	52.1	Buncrana	49.0
Westport	51.7	Londonderry	48.9
Dunmore	51.6	Armagh	48.6
Cove	51.5	Waterford	48.6
Kilrush	50.9	Athy	48.4
Killebegs	50.8	Markree	47.8
Courtown	50.3	Portarlington	47.3
Killough	50.2		

The highest degree of heat noted at Dublin, within the last one hundred and fifty years, was 98° F., in June, 1811; the highest at Limerick, 100° in the shade and 130° in the sun, June 12, 1842; the highest at Cork, 83°, in June, 1822; the highest at Belfast, in August, 1819, which was 80°.

The lowest degree of cold noted at Dublin within the above-named period was 7°.9, in January, 1740; the lowest at Connaught, at zero, in May, 1821; the lowest at Belfast, below zero, in January, 1861.

The annual average depth of rain which fell at various places, for a series of years, was as follows:

Places.	Depth in inches.	Places.	Depth in inches.
Cork	39.06	Londonderry	34.23
Castlecomer	37.90	Queenstown	30.51
Markree	37.56	Dublin	29.14
Armagh	34.68	Athlone	29.07

The greatest number of "wet" days in a year, or those on which rain or snow fell, noted at Dublin, is 217, in 1849; the least number, 105, in 1817, fifty of which occurred from May to August, inclusive.

The greatest number of wet days in a year noted at Markree is 289, in 1849. The greatest number of wet days in a year at Athlone is 200, in 1848; the least number, 172, in 1847.

The greatest recorded depth of rain which fell at any one place on the island is 54.5 inches, at Cork, in 1738.

The least depth in a year at any given place was 21.23 inches, at Portarlington, in 1851.

The aboriginal Irish divided the year into two seasons—summer and winter; the former commencing on May day, and the latter in November. Subsequently the quartine division was adopted—spring, or sowing time, when vegetation first commences and leaves and blossoms burst forth, which ordinarily dates from St. Bridget's festival, February 1; May day, the beginning of summer, and June 21, midsummer; harvest, or autumn, the seed-time, or gathering, dates from the beginning of August, and corresponds with the English Lammas. The winter quarter commences, as formerly, on the first of November.

The rainy season usually sets in about the first of July, and continues more or less wet until September or October, when there is often fine weather for five or six weeks. The most disagreeable feature in the climate of Ireland is the constant moisture without rain.

The prevailing winds are from the west, which occur most in autumn, and the least in the spring; or, by months, the most from July to November, and the least in May; the average number of days in a year being about 100. Next in frequency are the winds from the southwest, which prevail most from November to February, averaging about 57 days in a year. Next in order stand the east winds, which occur most in April, May, and September, giving an annual average of 45 days. Next in frequency are those from the northwest, especially in the summer quarter. The remaining winds and calms are about equally divided, blowing from the north, northeast, south, and southeast.

The following extraordinary cosmical phenomena, as connected with the seasons and climate of Ireland, show the disadvantages which the people of that island sometimes have to encounter:

In the year 1848 the frost was so intense at Dublin, from the 2d of December to the 10th of February, that the river Liffey was frozen sufficiently hard to allow people to dance, run, and play at foot-ball on the ice; and the depth of snow, in the course of that winter, is represented to have been incredibly great.

The winter of 1683–'84 is recorded as being of great length and severity.

The frost commenced on the 1st of December, and continued, for the most part, until the 26th of March. The river Lee was frozen for many weeks, at Cork, so hard that carriages passed on the ice from Ferry Slip to East Marsh. The frost on the Shannon, and generally throughout the island, was unprecedentedly intense.

In 1728 ice was formed on the Liffey on the 23d of June. The same year the oat crop was destroyed in the county of Waterford, by high winds.

In 1733 the winter was so mild that primroses and violets bloomed in the open air.

The years 1739, 1740, and 1741, were the most remarkable recorded in the Irish annals. The summer and autumn of the former were unusually wet. Early in November of that year there occurred a very sharp, cold, northeast wind, which continued about three weeks. This was succeeded by the severest frost ever remembered in the kingdom, which, in the course of the winter, entirely destroyed the potatoes that were left undug in the ground or stored in heaps in the fields; but the parsnips, and, in some instances the turnips, survived. On the evening of the 26th of December this great frost commenced, accompanied by a high, piercing southeast gale, which was followed by a long course of north and east winds until the 15th of February, 1740. During the month of January the most intense and severe cold prevailed throughout the island. The Liffey was frozen so hard that tables and forms were kept on the ice for selling liquors, &c. The waters all about Cork were also covered with ice, the people walking three miles on the Lee; and on the river of Galway, from West Bridge to Ferryland, and from Newcastle to Wood Quay, the ice was blackened by people at ball. In many parts of the island the water-mills were frozen up and stopped, so that corn could not be ground. The Zuyder Zee, in Holland, was also frozen, and the frost was uncommonly severe in most parts of Europe, great storms occurring as far south as Portugal and the north of Spain. Great havoc was experienced among animals as well as vegetables—evergreens, particularly the furzes, and many oaks, being killed. Large numbers of horses, cattle, sheep, deer, and rabbits froze to death or died from famine or disease. Birds of various kinds also perished from cold or the want of food, and myriads of fishes were afterwards found dead on the margins of the streams; and, in consequence of great scarcity and the want of wholesome provisions, vast numbers of people died from starvation and disease. Famine followed, and a long train of other calamities marked this awful visitation, in which dysenteries and fevers of the most malignant nature, and alarming epidemics, prevailed until the end of 1742. It is estimated that during this famine at least 300,000 people perished from pestilence and starvation, or were otherwise lost.

The summer of 1740 was uncommonly dry, with a predominance of northerly winds. At the beginning of May there were frost and snow; on the 11th, a gentle rain, an occurrence which had not happened for two hours at a time since the beginning of November before, the grain fields, gardens, and grass being mostly turned brown from dearth. The potato and grain crops having failed the following autumn, while other provisions bore double and treble the usual prices, great suffering, disease, and death were the consequent results. On the 21st of October, this year, the mountains near Dublin were covered with snow, and two days later it fell in the city itself. On about the 25th of the same month intense cold occurred at Belfast, with the greatest fall of snow and sleet ever before known in that part at that season of the year. The snow was so deep on the road to Ballymena that horses and their riders were buried in the drifts. On the 10th of December severe frost again occurs, followed by the greatest quantity of snow. The Liffey closes but opens again on the 23d with a great flood.

In 1749 hoar frost occurred near Dublin in June, which greatly injured the young apples and wall fruits, and protracted the growth of hay.

In September, 1752, several plants flowered a second time for the season.

In 1766 a remarkable fall of snow took place about Dublin, on the 15th of February, measuring, in some places, 15 feet deep. Many sheep and several travellers lost their lives. In some situations the tops of trees and snow formed one plane; and on the high roads passages were cut in the snow to the depth of a coach. In December of the same year poplars were in bloom.

In June, 1776, there was the most terrific thunder-storm at Clonegall ever remembered, attended with an amazing fall of flakes of ice; and at Monart, in the same shower, ice covered the ground to a depth of more than a foot.

The winter of 1783–'84 was uncommonly severe. The snow in January is represented to have been from 15 to 27 feet deep. The Liffey, the Thames, and the rivers of Holland were all locked up with ice.

In 1801 there were severe frosts in May. The same year the flax crops suffered in the county of Londonderry by what is termed "firing on the foot," which consists in reddish or brownish specks dispersed chiefly over the straw of the plant, thereby injuring the texture of the fibres more or less.

In 1807, about the middle of November, the snow near Dublin was 10 feet deep. Considerable numbers of animals perished, and in some instances, men. The potatoes which remained in the fields at that period in various parts of the island were nearly destroyed.

In January, 1814, the weather again was uncommonly severe. On the 27th and 28th of December preceding, a fog showed itself, in a slight degree at first, but increased in density until the 4th of January, accompanied by a remarkable deposition of hoar frost, which was succeeded by one of the heaviest falls of snow remembered by the inhabitants. On the 13th of that month the streets of Dublin were deserted, the snow five feet deep, and deeper in the country. The crops of the following season were regarded as the most abundant that had occurred for fifty years.

On the 16th of December the same year a most appalling hurricane occurred, the wind generally blowing from the southwest. The river Shannon swelled to an unprecedented height, overflowing its highest banks, and flooding the country for miles in extent. Much of the finest timber of the island was prostrated, and immense damage was done to other property, public as well as private.

In October, 1819, another great snow fell at Dublin, an occurrence which had not been observed so early in the season for eighteen years. In the January preceding anemonies and roses flowered in the open air. The summer was uniformly hot.

The inclement winter of 1820–'21 was characterized by a severe frost and deep snow, which were succeeded by a spring noted for its drought, violent storms, and extensive inundations. Early in January the navigation in the canals was suspended, owing to the great quantity of ice. From the continuance of easterly gales and the great depth of snow the intercourse with Dublin was seriously interrupted by water as well as by land. The May following was cold and dry, which much retarded the planting of potatoes. June, also, was cold, frosty, and alternated by northerly winds and scorching suns, which proved injurious to all growing crops. Throughout July and August there was a promise of a good harvest; but heavy rains commenced near the end of the last-named month, and continued almost unabated till the end of September. The sudden rains, in the first instance, greatly injured the wheat, and completely ruined the flax. The consequent floods not only carried off the hay, but literally swept away nearly all the potato crops within their reach. In October and November the rain still poured in torrents, very few potatoes harvested, and in most places so small and deficient that they were hardly worth digging. December came in with a violent storm, especially felt in the region about Dublin.

A flood of unusual height occurred on the Shannon, and miles of the adjacent country were submerged, presenting the appearance of a boundless sea, covering for weeks the potato fields, and not only souring the deficient crop, which had not been harvested, but prevented all access to the few pits containing those that were dug. Such misery the following winter had rarely been witnessed before; typhus fever on the one hand, and starvation on the other, in many parts of the island, were added to the general distress.

We close these notices by alluding to the remarkable pestilential period in which is recorded one of the most alarming and dire calamities that had occurred in Ireland or elsewhere for at least one hundred years, the "general potato failure," and the "great famine and pestilence" of 1845 to 1850. Although usually dated from the summer of 1845, by referring to the records of the few years preceding, it will be seen that the "epidemic constitution" of this tuber had commenced as early as the year 1839. The failure of the crop was only partial up to 1845; almost entirely in 1846; very extensive in 1847; and nearly as much so in 1848; and as the disease rose to the culminating point, it as gradually sunk, so that in 1849 and 1850 potato failures, though not general, were more or less extended and intense; and, year by year, the epidemic gave way, until the conditions of the atmosphere appeared to have been changed by the severe frost of 1855.

The year 1839, when an unmistakable failure of this crop occurred, was characterized by an amount of moisture in Ireland unparalleled in her annals, the quantity falling at Dublin that year being nearly 39 inches, or about 10 inches more than had fallen annually for the period of sixteen years. A portion of 1840 was likewise characterized by excessive rains, although less than in the year preceding they came at unpropitious seasons, and were followed by a partial failure of the crop. The year 1841, though not specially notable for its wetness, was cold and frosty, but was excessively rainy in August, and the number of days of falling weather that year (246) was unusually great, causing a partial destruction of the crops, particularly in the counties of the south. In 1842, which was more favorable to vegetation, and brought forth good crops of wheat, proved, in many instances, disastrous to the potatoes, from spring inundations; but the crops, in general, were good. The year 1843 was more fatal to animal than to vegetable life, epizootics largely predominating over the diseases of plants. In 1844, the severity of the seasons again acting prejudicially upon vegetation, there was a partial failure of the potato, and destitution followed in its wake.

The year following, 1845, was marked by unusual phenomena, which, doubtless, tended to the destruction or deterioration of the crops. On the 28th of January a great snow storm occurred at Westport, Tuam, and Ballinrobe. March 14, a severe frost, and the Liffey frozen above King's bridge, followed by a heavy fall of snow on the 19th. April 9th, snow on the Dublin mountains; and during some nights in August untimely frosts. At Limerick there were showers of sleet in the midst of dog days.

On the 30th of June, 1851, a very remarkable thunder shower was experienced at Markree castle, in the county of Sligo. After the first flash of lightning a strong breeze arose, followed almost immediately and simultaneously by a most extraordinary fall of rain, with some hail. It lasted fifteen minutes, and during this time there fell one and a half inch of water, or at the rate of nine feet per diem!

THE CULTURE AND PREPARATION OF FLAX IN IRELAND.

The modes of cultivating flax in Ireland vary according to the nature of the soil, the enterprise or ability of the farmer, and his requirements as regards the rotation of crops. With the exception of those who strictly adhere to the "Courtrai system," described in another part of this report, and those who

follow the directions issued by the "Northeast Agricultural Association of Ireland for Promoting the Growth of Flax," the system usually aimed at is the one introduced into the island by Louis Crommelin more than a century and a half ago. The crop generally succeeds potatoes—always in small holdings—in which case the winter fallow is carefully dug over with the spade, lightly stirred with the plough, rarely "ribbed up," or merely harrowed down in the spring, without any digging or ploughing, it being considered better to sow the seed on a rich surface which has been exposed to the frost and snow. This cultivation, especially among the small farmers, is often marked by slovenliness and neglect, the fields for miles presenting the appearance of the yellow heath with which the island abounds, from the abundance of charlock in flower in May and June. By this wasteful method the land literally becomes scurged, and the quality of the fibre of the flax sustains a proportionate injury from careless preparation, the soil being not only deprived of its fertilizing elements by injudicious rotation, but is forced much beyond its strength, as though it required no amendments or recuperating powers.

The following directions for the management of the flax crop, originally recommended by the "Royal Society for the Promotion and Improvement of the Growth of Flax in Ireland," and revised by the special committee of the "Northeast Agricultural Association of Ireland for Promoting the Growth of Irish Flax," issued in 1860, are given in an abridged form, with a belief that they contain sufficient information for the cultivation of the plant, and to economize and reduce it to a proper state for breaking and scutching.

Soil and rotation.—By attention and careful cultivation good flax may be grown on various soils, but some are much better adapted for it than others. The best is a sound, dry, deep loam. It is almost essential that the land should be properly drained and subsoiled, as, when it is long saturated either with underground or surface water, a good crop need not be expected. The subsoiling should be executed the year of the green crop, so as to be completed at at least two years before the flax is grown.

The best rotation is to grow after wheat on average soils; but in poor soils, where wheat does not succeed, it is often better to grow after potatoes. Flax should on no account be grown oftener than five years on the same ground, and once in seven is considered safer. Any departure from this system of rotation is likely to cause disappointment and loss.

Preparation of the soil.—One of the points of the greatest importance in the culture of flax is by thorough draining, and, by careful and repeated cleansing of the land from weeds, to place it in the finest, deepest, and cleanest state. This will make room for the roots to penetrate, which they will often do to a depth equal to one-half the length of the stem above ground.

After wheat, one ploughing may be sufficient on light, friable loam, but two ploughings are better; and on stiff soils three are advisable—one immediately after harvest, across the ridges, and two in spring, so as to be ready for sowing in the first or second week in April. Much will, of course, depend on the nature of the soil and the knowledge and experience of the farmer. The land should be so well drained and subsoiled that it can be sown in "flats," which will give more even and much better crops. But until the system of thorough draining be general, it is advisable to plough early in autumn, to a depth of six or eight inches. Throw the land into ridges, that it may receive the frost and air, and make surface drains to carry off the rains of winter. Plough again in spring three or four inches deep, so as to preserve the winter surface for the roots of the flax. The spring ploughing should be given some time before sowing, to allow any seeds of weeds in the land to vegetate, and the harrowing in of the flax seed will likely kill them, and save a great deal of after-weeding. Following the last harrowing, it is necessary to roll, to give an even surface and consolidate the ground, breaking up this again with a short-tooth or seed harrow

before sowing, which should be up and down, not across the ridges or anglewise. These operations can be varied by any skilful farmer to suit peculiar soils or extraordinary seasons. The object is to have clean, fin soil, as like as possible to what a garden soil should be.

The rotation recommended by a gentleman of considerable experience is as follows:

Average soils.	*Poor soil.*
1. Grass.	1. Grass.
2. Oats.	2. Oats.
3. Potatoes or turnips.	3. Potatoes.
4. Wheat.	4. Flax.
5. Flax.	5. Hay.
6. Clover hay.	

Sowing.—The seed best adapted for the generality of soils is Riga, although Dutch has been used in many districts of country for a series of years with perfect success, and generally produces a finer fibre, but not so heavy a crop as Riga. In buying seed select it plump, shining and heavy, and of the best brands from a respectable merchant. Sift it clear of all the seeds of weeds, which will save a great deal of after trouble when the crop is growing. This may be done by farmers, and through a wire sieve, twelve bars to an inch. Home-saved seed has produced excellent crops, yet it will be best, in most cases, to use the seed which is saved at home for feeding, or to sell it for the oil mills. The proportion of seed may be stated at one Riga barrel to the Irish or plantation acre, which would be equivalent to nearly two Winchester bushels and a peck to a statute acre*. It is better to sow rather too thick than too thin, as with thick sowing the stem grows tall and straight, with only one or two seed capsules at the top; and the fibre is found greatly superior in fineness and length to that produced from thin sown flax, which grows coarse and branches out, producing much seed, but a very inferior quality of fibre. The ground being pulverized and well cleaned, roll and sow. If it has been laid off without ridges, it should be marked out in divisions eight or ten feet broad in order to give an equable supply of seed. After sowing, which should be done by a skilful person, as the seed is very slippery and apt to glide unevenly from the hand, cover with a seed-harrow, going twice over it—once up and down, and once across or anglewise, as this makes it more equally spread, and avoids the small drills made by the teeth of the harrow. Finish with the roller, which will leave the seed covered about an inch—the proper depth. The ridges should be very little raised in the centre, when the ground is ready for the seed; otherwise, the crop will not ripen evenly; and when land is properly drained there should be no ridges. Rolling the ground after sowing is advisable, care being taken not to roll when it is so wet that the earth adheres to the roller.

Weeding.—If care has been paid to cleaning the seed and the soil, few weeds will appear; but if there be any they must be carefully pulled. It is done in Belgium by women and children, who, with coarse cloths around their knees, creep along on all-fours. This injures the young plant less than walking over it, which, if done, should be by persons whose shoes are not filled with nails. They should work also facing the wind, so that the plants laid flat by the pressure may be blown up again, or thus be assisted to regain their upright position. The tender plant pressed only one way, soon recovers, but if twisted or flattened

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* One Riga barrel of flax-seed contains 3½ imperial bushels, or about 3⅔ Winchester bushels of the United States.

One Irish or plantation acre is equivalent to 1.61983 statute acres of England and the United States; or, more accurately, 121 Irish acres equal 196 statute acres.

by careless weeders, it seldom rises again. The weeding should be done before the flax exceeds six inches in height.

Pulling.—The time when flax should be pulled is a point of much nicety to determine. The fibre is in the best state before the seed is quite ripe. If pulled too soon, although the fibre is fine, the great waste in scutching and hackling renders it unprofitable; and if pulled too late the additional weight does not compensate for the coarseness of the fibre. It may be stated that the best time for pulling is when the seed is beginning to change from a green to a pale brown color, and the stalk becomes yellow for about two-thirds of its height from the ground. When any of the crop is lying and suffering from wet, it should be pulled as soon as possible and kept by itself. So long as the ground is undrained and imperfectly levelled before sowing the flax will be found of different lengths. In such cases pull each length separately, and, if possible, keep it separate in the steep-pool. Where there is much second growth, the flax should be caught by the puller just underneath the bolls, which will leave the short stalks behind. If the latter be few it is best not to pull them at all, as the loss from mixture and discoloration by weeds would counterbalance the profit. If the ground has been thoroughly drained and laid out evenly, the flax will likely be all of the same length. It is most essential to take time and care to keep the flax even, like a brush at the root ends. This increases the value to the spinner, and, of course, to the grower, who will be amply repaid by an additional price for his extra trouble. Let the handfuls of pulled flax be laid across each other diagonally, to be ready for separating the seed.

Rippling.—This operation should be done at the same time, and in the same field with the pulling. If the only advantage to be derived from rippling were the comparative ease with which rippled flax is handled, the practice ought to be adopted; but, besides this, the seed is a very valuable part of the crop, either for the oil mill or for feeding purposes at home. The apparatus for rippling is very simple, consisting of a row of iron teeth screwed into a block of wood. The best ripples are made of half-inch square rods of iron, placed with the angles towards the operator, three-sixteenths of an inch asunder at the bottom, half an inch at the top, and eighteen inches long, so as to allow a sufficient spring, and to save much breaking of flax. The points should begin to taper three inches from the top.

The ripple is to be taken to the field where the flax is being pulled, and screwed down to the centre of a nine-foot plank resting on two stools. The ripplers may either stand or sit astride the opposite ends, and should be at such a distance from the comb as to allow them to strike it properly and alternately. A winnowing sheet must be placed under them to receive the bolls as they are rippled off, and then the ripplers are ready to receive the flax just pulled, the handfuls being placed diagonally and bound up in a sheaf, which is laid down at the right hand of the rippler and untied. He takes a handful with one hand, about six inches from the root ends, and a little nearer the tops with the other. He spreads the top of the handful like a fan, draws the one-half of it through the comb and the other half past the side, and, by a half turn of the wrist, the same operation is repeated with the rest of the bunch. Some, however, prefer rippling without turning the hand, giving the flax one or two pulls through, according to the quantity of bolls. The flax can often be rippled without being passed more than once through the comb. He then lays the handfuls down at his left side, *each handful* crossing the other, when the sheaf should be carefully tied up and removed. The object of crossing the handfuls so carefully after rippling, when tying up the "beets" for the steep, is that they will part freely from each other when they are taken to spread out on the grass, and not interlock and be put out of their even order, as would otherwise be the case. If the weather be fine, the bolls should be kept in the field, spread on winnow-cloths, or other contrivance for drying, and if turned from time to time they

will soon dry. Passing the bolls first through a coarse riddle, and afterwards through fanners, to remove straws and leaves, will facilitate the drying. If the weather be moist, they should be taken in-doors, and spread out thinly and evenly on a barn floor or on a loft, leaving windows and doors open to allow a thorough current of air, and turned twice a day until no moisture remains. By this mode of *slow* drying the seed has time to imbibe all the juices that remain in the husk, and to become perfectly ripe. In fine seasons the bolls should always be dried in the open air, the seed threshed out, and the heaviest and plumpest used for crushing or sowing. The light seed and chaff form most wholesome food for stock. Flax ought not to be allowed to stand in the field, if possible, even the second day, but should be rippled as soon as practicable after it is pulled, and carried to the water to be steeped, that it may not harden.

Watering.—This process requires the greatest care and attention. River water is the best. If spring water must be used, let the pond be filled some weeks before the flax is put in, that the sun and air may soften the water. That containing iron or other mineral substances should never be used. If river water can be had, it need not be let into the pond sooner than the day before the flax is to be steeped. The best size of a steep-pool is 12 feet broad, 18 feet long, and from 3¼ to 4 feet deep. Place the flax loosely in the pool, in one layer, somewhat sloped, and in regular rows, with the root ends underneath, the tie of each row of sheaves to reach the root of the previous one. Cover with moss sods, or old, tough lea sods, cut thin, and laid perfectly close, the "sheer" of each fitted to the other. Before putting on the sods, a layer of rushes or weeds is recommended to be placed on the flax, especially in new ponds. As sods are not always at hand, a light covering of straw may do, with stones laid on it, so as to keep the flax just under the water, and as the fermentation proceeds, additional weight should be laid on, to be removed as soon as the fermentation ceases, so as not to sink the flax too much in the pool. Thus covered, it never sinks to the bottom, nor is affected by air or light. A small stream of water, allowed to run through a pool, has been found to improve the color of flax. The average time for steeping sufficiently is from eight to fourteen days, according to the heat of the weather and the nature of the water. Every grower should learn to know when the flax has had enough of the water, as a few hours too much may injure it. It is, however, much more frequently *under* watered than *over* watered. The best test is the following: Try some stalks, of average thickness, by breaking the *shove*, or woody part, in two places, about six or eight inches apart, at the middle of the stalk; catch the broken bit of wood, and if it *will pull freely out, downwards, for that length, without breaking or tearing the fibre, and with none of the fibre adhering to it*, the flax is ready to take out. Make this trial every six hours after fermentation subsides, for sometimes the change is sudden. Never lift the flax roughly from the pool with forks or grapes, but have it carefully handed out by men standing in the water. It is advantageous to let the flax drain from twelve to twenty-four hours after being taken from the pool, by placing the bundles on their root ends, close together, or on the flat, with the slope. But the heaps should not be too large, otherwise the flax will be injured by heating.

Spreading.—Select, when practicable, clean, short, thick pasture ground for this operation, mowing down or removing any weeds, if necessary, that rise above the sward. Lay the flax evenly on the grass, and spread very equally and thin. If the directions given under the head of *rippling* have been attended to, the handfuls will readily come asunder without entangling. Some persons recommend turning the flax on the grass with a long rod.

Lifting.—Six or eight days, if the weather is showery, or ten or twelve days, if it be dry, should be sufficient for the flax to remain on the grass. Ten days may be taken as a fair average in ordinary weather. A good test of its being ready to lift is to rub a few stalks from the top to the bottom; and when

the wood breaks easily, and separates from the fibre, leaving it sound, it has had enough of the grass. Also, when a large proportion of the stalks is perceived to form a *bow and string*, from the fibre contracting and separating from the woody stalk. But the most certain way is, to prove a small quantity with a handbreak or in a mill. In lifting the flax, keep the lengths straight and the ends even; otherwise great loss will occur in the process of scutching. If heavy dews or damp weather prevail, do not lift too late in the day. Let the flax be set up to dry for a few hours, and afterwards tie it up in small bundles; and if not taken soon to be scutched, it will be much improved by being put up in small stacks, loosely built, with stones or brambles in the bottom to keep it dry and allow a free circulation of air.

Drying.—This operation, if by fire, *is always most pernicious.* If properly steeped and grassed, no such drying is necessary; and to make it ready for breaking and scutching exposure to the sun is sufficient.

In arranging the following instructions for the cultivation and preparation of flax from Crommelin's essay, referred to in another part of this report, I have adhered as closely to the original as might be deemed necessary, slightly changing the language, in some cases, with the view of preserving uniformity of style. Notwithstanding these instructions may be liable to be considered as antiquated, it may be stated that they are followed, in principle, in Belgium, Holland, and France, as well as in Ireland, at the present day, where the finest and the most enduring linen fabrics have been made for at least one hundred and fifty years. More rapid and expeditious methods have been adopted, in many instances, it is true, from modern invention, which answer for a rougher and an inferior class of goods; yet it is a question unsolved whether the same or similar tardy processes of preparation, which were practiced on the Nile four thousand years ago, will not necessarily be continued by unnumbered generations to come.

Selection and choice of Seed.—The first thing requisite to have good flax is that your seed be good, which ought, from time to time, to be renewed, and brought fresh into the kingdom from Riga or Narva, for flax-seed being constantly made use of in one and the same soil will degenerate. Shifting the soil in the same country will much help it; but in France and Flanders they find by experience that fresh supplies of seed from Riga and Narva are requisite to produce good crops.

You will perceive your flax-seed to be degenerated by observing whether the plant grows to a sufficient length; or if instead of one or two stalks, which good seed generally sends forth, there be more; or if your flax has many heads it is then high time to shift or renew the seed.

Soil and Culture.—Your next care ought to be in the choice of your soil for flax, for all soils are not proper, generally speaking. Land proper for barley is also good for flax; therefore the next year after you have had a crop of barley you may venture to sow flax-seed in the same ground. As soon as the barley is harvested and off the field, give it a good ploughing, and harrow so as to leave it flat and even, without ridges. In March following, plough and harrow level again; and about the middle of April, if the weather be dry, plough and harrow level for the third time, to the end that your flax may grow of equal length. Then, as the weather is dry, sow the seed in an equal manner, carefully covering it with a harrow. Each Irish plantation acre will take about a barrel of seed, (about two bushels and a peck to an acre of the United States.)

Flax will also grow in other soils than those proper for barley, provided they are not cold or spewy, overrun with rushes and flags, or too sandy or too stiff with clay.

When your flax has shot three or four inches above the ground it must be carefully weeded, and so let it stand until it is ripe.

Pulling.—One of the greatest niceties in raising flax is to know when it is ripe and fit for pulling, for if this be done before, the fibre is always weak, and

the seed unfit for sowing. The way to know whether it is ripe is to observe when the stalks and little seed-pods are growing yellow, and the leaves begin to fall. Cut some of these pods where the seed lies crosswise, and if you find the seed well colored and filled you may conclude that the flax is sufficiently ripe, and ought to be pulled. The least time now lost might be fatal, for the flax might as well be under as over ripe.

In pulling flax you ought to be extremely careful to observe that the roots meet, or be kept together, as even as practicable. Each quality or sort must be pulled apart and kept separate, as it would be difficult to assort them afterwards. By different qualities is meant the degrees of fineness or coarseness of the stalks, coarse, middling, and fine. The best is the small-strawed, which produces the finest flax. When two handfuls of a sort have been pulled they should be laid by themselves, beginning with the coarsest and ending with the finest. As soon as the puller has gathered sufficient to make a "stonk," or small bundle, which should never be bigger than a man's thigh, it should be set up in the field to dry for four or five days, keeping each quality separate, taking care, during that time, to raise such as have been overturned by the wind. If within these four or five days you find that the flax is quite dry, the stonks may be placed nearer together, in the following manner: Draw them into lines, about two feet broad, with the roots on the ground, and thus let them stand, closely packed, still preserving this precaution not to mingle the different sorts together, exposed to the air eight or ten days. If you are apprehensive of wet weather, you must defend the finest flax by covering it over with the coarse. If within the last-named period the flax becomes well dried uncover it on a fine day, so as to let it further dry on exposure to the sun, and then turning half the roots one way, and half the heads the other, bind the stonks or little bundles into sheaves of the size of a man's waist. After the flax is so dry that there is no danger of its heating, if you design to save the seed for sowing, it should be stored in a convenient barn, where it should remain until the following spring. For by thus keeping the seed is preserved from injury, better ripened and filled, so that it will not degenerate near so soon as it otherwise would. The poorest or inferior sorts may be divested of its seed and watered soon after it is pulled. But in the winter or spring of the year, as you may have occasion for the seed designed for sowing, it must be removed or threshed out, being careful again to keep the different qualities of the flax separate, securely tied up in large sheaves, with half the ends reversed, as above described. After the seed intended for sowing is threshed out and cleaned, if there is danger of its heating, it must be frequently stirred or turned in order to expose it equally to the air.

Watering or Rotting.—Your next care is to water the flax, on which mainly depends the ultimate success. The person who has the care of this operation should be judicious and diligent; the quality of the water should be well considered; the temperature and season of the year; and the quality and condition of the flax which you design to rot.

First, as to the quality of the water, the best is that of your lakes or "loughs," especially such as have some motion, and do not perfectly stagnate, for such are nowise proper. But that seldom happens in this kingdom, as most of the loughs are sources of rivers, or have currents gently passing through them. Where lakes are not conveniently at hand pits may be made near some running stream, which may vary in size in proportion to the quantity of flax you design to rot. In making the pits, care should be observed to choose a place where the sun will tend to warm the water, for the warmer it is, as raised by spontaneous heat, the sooner and better will the flax rot. The pits should be about three or four feet deep, and so contrived that the same quantity of water may run off at the lower end as comes in at the upper from the running stream. By these means the flax will get a good color, which is impossible to obtain in stagnant ditches and pools. Bog water, or that which is rough and hard, and will not bear soap,

is improper for flax or hemp. The former discolors the fibre, the latter makes it hard and difficult to work.

As to the temperature and season of the year best for watering flax, when the water is warm and kindly certainly is the most favorable; not but the operation may be performed either in autumn or spring, which may require double the time that it would in summer when the season is warm. In hot weather flax will rot in ten or twelve days; whereas in fall or spring it requires three or four weeks, more or less, according to the temperature of the water and air.

As to the character or quality of the flax, it must be borne in mind that each sort must be kept separate, as the coarse will not require half the watering of the fine; what would do for the one would ruin the other.

These precautions observed, you can proceed to water the flax by placing the sheaves as close together as they can be laid in the lake or pit. As it will float on the surface you must not fail to turn it each day it is in the water until the operation is complete. If the weather be warm, coarse flax will be watered in ten or twelve days; the finer qualities will take a much longer time. But do not depend upon computations of time, but rather form your judgment by the following trial: Take from the centre of a sheaf a small handful, and gently break some of the stalks, one by one, about three inches above the roots; then softly draw the fibre or bark towards the top end of the straw, and if you find that it separates freely from the woody part of the stalk you may conclude that this quality is sufficiently watered; but if the bark still clings to the stalk you should let it continue in the water another day, and, upon a second trial, if it separates well, lay such handfuls carefully apart exposed to the air to dry. A few hours after, if thoroughly dried, break five or six stalks with your nail in several places, and if you find that they easily break, and by rubbing them between the hands the woody parts freely separate from the fibre, the flax of that sort or quality is sufficiently rotted, and should be taken out of the lake or pool. In like manner you may proceed with the other sorts.

When you take the flax out of the water wash it clean of the filth it may have contracted, and spread it even and thin in straight lines or rows, with the root ends all one way, on the grass of a smooth meadow, to perfect the rotting and get it in readiness to scutch. As no injury can be done to the flax if under watered, the deficiency can be remedied by "grassing," as above; but if over watered the fibre is weakened if not entirely spoiled. If the weather be moist during the time of grassing, the flax must often be turned by thrusting under it a long, straight wand or rod; but usually it will not be required to be turned but once, which should be done when you find that the side next to the sun and wind becomes of a good color, free from blackness or duskiness contracted by the watering or filth and dirt. The underside, or that which first lay next to the grass on turning, will not require near the time to complete the operation or obtain a proper color, as the upper or that which was first exposed to the wind and sun. Coarse flax will grass sooner than fine, and the proper criterion for knowing whether the process is complete is an actual trial by breaking with the hands or a machine.

The flax being thoroughly grassed, the next operation is to collect it into stacks or store it in a barn. If the meadow on which it has been grassed be swabby and damp, it should be removed at once, in a fair day, to drier ground, and raised into small stonks, after the manner directed when pulled. When you are sure it is past the danger of heating in the stonks, bind it into sheaves and stack or store it up in a dry barn for use.

Flax may also be prepared for scutching without watering by grassing it a sufficient time to cause the straw to corrupt; yet it is better to water it, where it can be done without great inconvenience or expense. But it is not practicable to produce a good fibre without grassing, as the influence or effects of the water on the straw is to separate the fibres from the other parts which would not

otherwise be done, and thereby render it suitable to be converted into the finest and softest thread and yarn.

Do not suffer your flax to be dried by fire of any kind, as it would be liable to discolor it and render the fibre unpliable and hard. All artificial heat is unequal; you cannot prevent the drying of one part while another is undried, whereby the fibre in a measure is rendered useless.

THE COURTRAI SYSTEM OF GROWING FLAX.

This system differs from the two preceding mainly in drying the flax after pulling, and stacking it in the field or in a farm-yard, after the manner of ordinary grain, where it remains until the following spring, when it is considered fit for steeping. If well secured, however, it is further improved by three years' keeping, as it will scutch much easier and to more profit for a finer class of goods.

In order to insure the preservation of the seed designed for sowing, care is taken not to tie the flax into beets or sheaves before it is thoroughly dried, but to leave it in small wind-stacks in the field, placed on cradles or poles above the ground, to prevent it from accumulating moisture or wet, thatching each stack with straw, like a gable roof. When well dried, it is converted into larger stacks and secured from rain, or is stored in a barn or loft, in readiness for rippling out the seed the following winter or early spring.

By this system the work requires to be carefully executed, as carelessness or inattention would diminish the value of the straw, and result in inferior fibre. When made up for drying in large sheaves, the straw is much injured, the outside stalks being discolored by the heat of the sun before the inside of the sheaf is dry. The stems should be laid together in bunches, about once and a half larger than a man can grasp in one hand, spread a little, and laid on the ground in rows after each puller, the bunches laid with tops and roots alternately, which prevents the seed-bolls from sticking to each other in lifting. It should be stooked as soon after pulling as possible, and never allowed to remain over night unstooked, except in settled weather. The stooking should go on at the same time as the pulling, as if flax is allowed to be wet by rain while on the ground its color is much injured. A well-trained stooker will put up the produce of an acre or more in good order in a day, with two boys or girls to hand him the bunches. The flax should be handed with the tops to the stooker, and the handfuls, as pulled, are set up, resting against each other, the root ends well spread out, and the tops meeting like the letter A. The stooks are made eight or ten feet in length, with the ends kept firm by short straps. They should be quite narrow on the top, and lightly put up, so that they may get the full benefit of the air. In six or eight days, at most, after being pulled, the flax should be ready for tying up into sheaves, of the size of those of wheat or rye. It is then ricked, and allowed to stand in the field until the seed is dry enough for stacking. To build a rick, lay two poles parallel on the ground, about a foot apart, with a strong upright pole at each end. The rick is then built the length of a sheaf in thickness or breadth. The bottom poles are laid north and south, so that the sun may penetrate both sides of the rick in the course of a day. The sheaves should be laid tops and root ends alternately, built seven or eight feet high, with a single row on the top, running lengthwise the rick or across the others, and another row as before, but with the tops all the same way, which gives a slope to shed off rain. The rick is finished by putting on the top a little straw, bound on with a rope. In this way, if properly built, it will stand secure for months; or the flax can be put into a barn, if preferred. In either case, the seed is to be taken off in the winter, and the straw steeped in the following May.

When dry, the seed is usually threshed out with common flails, and cleaned through fans, in which condition it is fit for crushing, and the heaviest and

plumpest selected for sowing, and the inferior is disposed of for crushing or feeding to stock.

PROCESSES OF PREPARATION OF THE FLAX PLANT IN IRELAND.

The great interest manifested in the improvement and extension of the culture of flax in Ireland, as well as in other countries, for some years past, has led to a similar feeling towards the process of its preparation; and the attention of scientific and inventive minds has more recently been directed to its investigation. Various analyses and microscopic examinations of the whole plant have been made by eminent savans, which have materially aided in elucidating these inquiries; and, instead of adhering empirically to ineffective and injudicious plans for its attainment, they are now enabled to employ the best agents and means for the purpose that practical skill and science have brought to light.

In rotting and preparing the plant for the spinner, however, it may be stated that, except for a coarser or inferior class of goods, the processes of accelerating the disintegration of the fibres simply by means of warm water or steam, by solutions of alkalies and acids, by maceration, wet rolling, &c., are all defective, and attended by more or less loss from disruption or other weakening effects, and are now being abandoned.

The fibres of the bark of the flax plant, as remarked in the former part of this report, consist mainly of minute cylindrical tubes, cemented together, as it were, by a gum-like substance, which it becomes necessary to dissolve or decompose to prepare the flax for spinning. If abruptly treated while thus imprisoned in the gum, as, by sudden expansion by heat, or rudely disturbed by mechanical means, they break or crack more or less at right angles, and hence the injury to the cloth and thread made thereof. The consequent result in Ireland has been to return, in principle, to the ancient, gradual process of rotting, with some modifications, and either to scutch and hackle the flax by hand, as formerly, or by the improved machines of McBride, McAdam, Rowans, and others, in a dry state. It appears, then, that the principles of dressing flax, notwithstanding the rudeness of the implements used for the purpose, were as well understood, practically, one hundred and fifty years ago, as they are at the present day. Crommelin, the ingenious author, already quoted, descants on the subject in the following words: "The hackling of hemp or flax is naturally, and, of course, the next thing to be treated of. This is to be more or less done according to the use you design to apply them; as, for instance, if you design flax or hemp for gross or coarse yarn, you need not hackle in that case but with your large toothed hackle; if you design it for finer uses, you must begin with your coarse hackle, and hackle it again in the second hackle. If you would have your hemp or flax brought to be yet finer, you must hackle it a third time, and that in your finest hackle. You must always work hemp and flax gradually, and not hackle at first with your finer or finest hackle, for if you do you must expect more tow than flax or hemp fit for use and service. When you have a mind to have extraordinarily fine flax you must not in the least hackle it, but you must work it entirely by the help of a brush for that purpose, made of hog's bristles, and stiffened artificially with glue. This brushing of flax does not so wear and tear it as the hackles do, but by easy degrees separates the threads and fibres thereof asunder. Your flax will be incomparably finer and longer, and with less waste, by preparing it in this manner, than if you wrought it with the hackles."

FLAX IN GREAT BRITAIN.

The cultivation of flax in Great Britain is believed to be coeval with that of the cereal grains, but, as in her sister island, we have no records to show when nor by whom it was introduced, unless we accept the statement that it was done in the Norman invasion in 1175. Of the existence of home-made linen from an

early period there can be no doubt. It was common in the eighth century, and burnt bones have been found in British barrows, protected by an envelope of linen cloth. The garments of the Anglo-Saxons and Normans were composed of it, and in some instances it was dyed with the murex of a scarlet hue. Du Cange mentions linen drawers, linen slippers or shoes, unbleached linen, and the preparation of flax. In the year 1531 a statute was passed in England making it obligatory for every holder of sixty acres of tillable land to cultivate one-fourth of an acre per annum with flax. It is stated on other authority that hemp and flax were first sown in that country in 1533.

Anderson, in his "History of Commerce," traces some fine linen made in England in 1253. Table linen was not much in vogue in 1386, the year in which the "Linen Weavers' Company" was established in London by the Dutch.

In 1567 large numbers of Flemish settled at Canterbury, Norwich, Sandwich, Colchester, Maidstone, Southampton, and other places, on account of the Duke of Alva's persecution, among whom were weavers and makers of linen.

In 1579 linen-staining was introduced; and in 1590 sailcloth was first made.

Manufacturers also existed at Manchester as early as the year 1641, consuming Irish linen yarn. Strutt observes, however, that the manufacture was not carried on to an extra extent before the middle of the seventeenth century, and even was in its infancy in the reign of Charles II in 1661.

In 1743 linen handkerchiefs were first manufactured at Paisley, when about £15,886 worth were made.

In 1746 the "British Linen Company" was erected at London.

Manufactures of gauze, lawn, and thread began at Paisley in 1759.

The first regular bleach-field in Scotland was established about this period near Perth by an Irishman from the county of Antrim. Previous to this date only small bleach-greens existed on little "burns" or streams, and, as in Ireland in former times, the only alkali used in bleaching was the urine of cows, in which the cloth was first steeped, and then washed in a tub, the woman trampling it with her feet, and changing the water till it came off pretty clear. It was next beat on a stone, and spread out on the grass for some days, where it was well watered. These operations were repeated till it pleased the owner or wearer. In the course of time the application of science and skill has overcome the greatest difficulties in this art, and though they may challenge the world in their cotton goods, the Scotch have never been able, in the style and finish of their linen, to equal the Irish, to whom they send large quantities to be bleached.

The amount of linen manufactured and stamped for sale north of the Tweed in 1767 was 12,785,043 yards, valued at £633,860.

The linens stamped for sale in Scotland from 1772 to 1784 amounted to from 10,748,110 to 19,138,593 yards a year. The last named year the gauze, lawn, and thread manufactured at Paisley yielded £575,185, employing 26,664 hands. The gauze was valued at £350,900, and the handkerchiefs at £164,385.

It was not until near the end of the last century that flax spinning-mills were first erected in the north of England and in Scotland. Before that period the operation of spinning was performed by females in their own dwellings. Up to 1814 the yarn spun in the mills was sold to weavers or dealers, the latter of whom acted as agents between the weavers and spinners; but at the date last mentioned some spinners also became manufacturers of linen. It was at a still more recent date that power-weaving was applied to the making of linen fabrics in the kingdom, as will be seen by referring to this branch of the subject in Ireland.

In Scotland this manufacture was comparatively limited before the peace in 1815. The town and district around Dundee, in particular, have been the scene of a remarkable increase in this branch of industry from that period up to the last year. In 1814 the quantity of flax imported into that place for use in the

manufactories did not exceed 3,000 tons; but in the year ending May 31, 1833, the imports had increased to 18,777 tons, besides 3,380 tons of hemp. The quantities of linen, sailcloth, and bagging, into which these materials were made, and which were shipped from Dundee the same year, amounted to about 60,000,000 yards. The continued progress of the manufacture and trade in this district is further shown by the fact that in the year 1857 the imports had increased to 30,351 tons of flax, 6,926 tons of tow, 1,023 tons of hemp and codilla, and 24,341 tons of jute. The exports of linen and hempen goods from Dundee during the same year, ending December 31, were as follows:

Articles.	*Pieces.*
Osnaburgs	10,200
Sheetings	108,403
Bagging	6,652
Canvas	80,543
Dowlas	9,170
Sacking	156,008
Sundries	40,587

besides 2,885,120 pounds of flax yarns, and 7,400,960 pounds of jute yarns.

It may not be improper here to correct an error which prevails in certain quarters that the town of Dundee manufactures as much linen as all Ireland put together. This error, no doubt, was based upon the circumstance that Dundee swallows up more hemp and flax in the course of a year than are imported into the sister island, but which are worked up into a coarser class of goods, and, without taking into account that some 30,000 tons of flax are annually cultivated in Ireland, most of which is manufactured at home. The error, also, might have arisen from oversight in examining the official returns of the foreign exports of the United Kingdom. In 1825, for instance, the year preceding that in which a greater part of the linens shipped from Ireland fell under the regulations of the coast trade, the exports of linen cloth to all parts of the world amounted to 55,113,265 yards. Notwithstanding the manufacture has doubled in the island since that period, the same series of official returns shows that Ireland exported in 1859 only 4,063,655 yards, while Scotland exported 24,654,236 yards, and England 109,402,607 yards. It may further be stated that the value of the linen, in the aggregate, shipped from Belfast alone far exceeds that of Dundee.

The cultivation of flax in Great Britain in rotative order, comparatively, has never been materially extended, owing mainly to greater profits accruing from the occupancy of the land by the cereals and other crops.

The breadth of flax culture in Scotland, from the year 1854 to 1856, inclusive, was as follows:

Years.	*Acres sown.*
1854	6,670
1855	3,461
1856	2,723

The greater portion of this was grown in the counties of Sterling, Lanark, Aberdeen, Dumbarton, Fife, and Linlithgow.

In England—foremost as she is in almost everything that adorns and promotes her material interests or well-being—unaccountable as it may seem, no efficient means have ever been provided to collect her industrial statistics; and those directly connected with her agriculture never have been attempted to be taken by the government at all. Therefore, whatever may be given on the subject would be too limited for insertion, and might be calculated to mislead rather than to instruct. It may be stated, however, that considerable breadths of flax are occasionally sown in the counties of Cumberland, York, and others, and that, among the persons who have specially interested themselves in its culture

for some years past are his Grace the Duke of Marlborough; Mr. Warnes and Mr. Negus, of Norfolk; Mr. Fox, of Dorsetshire; and Mr. Burton, of Suffolk.

FLAX MILLS IN THE UNITED KINGDOM.

The extent of the linen manufacture of the United Kingdom conducted by motive power is shown in the following tables, compiled from the inspectors' returns:

Number of factories in 1835, 1850, *and* 1856.

Countries.	1835.	1850.	1856.
England and Wales	152	135	139
Scotland	170	189	168
Ireland	25	69	110
Totals	370	393	417

Amount of motive power in 1856.

Countries.	No. of horse power—steam.	No. of horse power—water.
England and Wales	3,639	1,005
Scotland	5,529	817
Ireland	5,219	2,113
Totals	14,387	3,935

Number of spindles and power looms, 1856.

Countries.	Spindles.	Power looms.
England and Wales	441,759	1,987
Scotland	278,304	5,011
Ireland	567,980	1,691
Totals	1,288,043	8,689

The whole number of scutching mills in Ireland in 1852 was 956, with 4,981 stocks. In 1855 the number had increased to 1,107, with about 5,800 stocks.

TRADE AND COMMERCE OF THE UNITED KINGDOM IN THE PRODUCTS OF THE FLAX PLANT.

IMPORTS.

Imports of scutched or dressed flax, tow, and codilla into the United Kingdom from all countries, at decennial periods, from the year 1800 *to* 1860.

Years.	*Quantities—tons.*
1801	13,686
1810	25,724
1820	19,119
1830	47,205
1840	62,912
1850	91,146
1859	71,602

The above-named quantities, imported in 1850, were supplied by various countries, as follows:

Countries.	*Tons.*
From Russia	62,037
Denmark	148
Prussia	13,163
Hanover	123
Hanseatic towns	1,030
Holland	6,662
Belgium	5,367
France	169
Italy, Duchy of Tuscany	36
Italy, Austrian territories	74
Egypt	2,325
British settlements, Australia	4
Other countries	8
Total	91,146

Imports of flax-seed into the United Kingdom from all countries, at various periods.

Years.	*Imperial bushels.*
1831	2,759,103
1840	3,558,070
1852	6,395,216
1853	8,282,680
1854	6,821,712

The amount of flax-seed imported into Ireland, for sowing, in 1854, was supplied as indicated in the following table:

Ports.	From Riga.	From Holland.	From other parts
	Barrels.	*Hogsheads.*	*Bushels.*
Belfast	30, 963	4, 954	5, 954
Derry	21, 571	1, 460	.....
Newry	10, 745	300	.....
Other ports	700	50	1, 200
	63, 979	6, 764	7, 154

The aggregate of the above-named quantities is equal to about 278,600 bushels.

The amount of flax and tow imported into Ireland, from all parts, in 1857, exceeded 13,000 tons, over 5,500 of which came into Belfast from Russia direct.

Imports of flax-seed, raw flax, fibre, tow, and the amount of fabrics and other materials resulting therefrom, into the port of Belfast, in 1860.

Articles	Denominations	Quantities.
Flax-seed	Barrels	828, 524
Linseed cake	Tons	54
Linseed meal	Tons	103
Flax fibre	Tons	8, 258
Tow	Tons	888
Waste	Tons	863
Thread	Packages	85
Yarn	Pounds	745, 920
Tissues	Packages	2, 891

The imports of raw flax fibre into Belfast from all parts, in 1850, were as follows:

Countries.	*Tons.*
From Russia	6, 216
Great Britain	3, 285
Coastwise	719
Belgium and Holland	210
Egypt	128
France	3
Total	10, 561

Imports of foreign and domestic flax, tow, and codilla into various ports in Great Britain, from all parts, in 1853.

Ports.	*Tons.*
Dundee	44, 874
Aberdeen	2, 587
Montrose	5, 094

Ports.	Tons.
Arbroath	3,888
Kirkcaldy	6,147
Hull	18,130
Total	80,720

The quantities as above imported into Dundee and Hull were obtained as follows:

Sources.	Dundee.	Hull.
	Tons.	Tons.
Riga	8,334	4,295
St. Petersburg	10,657	1,359
Archangel	6,074	923
Narva	1,142	112
Pernau	2,043	1,466
Revel	348	249
Memel	6,986	343
Libau	2,064	.....
Pillau	2,059	256
Totals from Russian and Prussian ports	39,707	9,003
Holland	521	3,382
Belgium	.....	5,232
Egypt	110	.....
Hamburg	722	447
Bremen	597	53
France	124	13
Totals, foreign	41,781	18,130
Coastwise	2,387	.....
By rail	706	.....
Total	44,874	18,130

EXPORTS.

Exports of linen fabrics from the United Kingdom to foreign parts, at decennial periods, from 1820 *to* 1860.

Years.	Linen fabrics.	Quantities.	Declared values.
1820..	Cloth, yards	38,127,898	.....
1830..	Cloth, yards	61,919,963	£2,017,756
1840..	Cloth, yards	89,373,431	3,194,827
	Yarn, pounds	17,733,575	822,876
	Thread, lace, tape, &c	.....	111,261
	Total value	.....	4,128,964

Exports of linen fabrics from the United Kingdom, &c.—Continued.

Years.	Linen fabrics.	Quantities.	Declared value.
1850..	Cloth, yards	122, 342, 516	£3, 589, 439
	Yarn, pounds	18, 220, 688	881, 312
	Thread, lace, tape, &c		358, 243
	Total value		4, 828, 994
1860..	Cloth, yards	143, 557, 449	4, 432, 823
	Yarn, pounds	31, 152, 026	1, 800, 927
	Thread, lace, tape, &c		369, 380
	Total value		6, 603, 130

Exports of linen cloth and yarn from Ireland to all parts of the world, at decennial periods, from 1701 *to* 1820, *inclusive.*

Years.	Linen fabrics.	Quantities.	Declared value.
1701..	Cloth, yards	188, 000	£14, 112
	Yarn, pounds	875, 996	39, 107
	Total value		53, 219
1710..	Cloth, yards	1, 688, 574	105, 538
	Yarn, pounds	893, 268	47, 854
	Total value		153, 392
1720..	Cloth, yards	2, 437, 984	121, 899
	Yarn, pounds	1, 760, 903	94, 334
	Total value		216, 233
1730..	Cloth, yards	4, 136, 203	206, 810
	Yarn, pounds	1, 129, 893	55, 486
	Total value		262, 296
1740..	Cloth, yards	6, 627, 771	441, 851
	Yarn, pounds	2, 076, 796	111, 257
	Total value		553, 108
1750..	Cloth, yards	11, 200, 460	653, 369
	Yarn, pounds	2, 505, 781	134, 238
	Total value		787, 607

Exports of linen cloth and yarn from Ireland, &c.—Continued.

Years.	Linen fabrics.	Quantities.	Declared value.
1760..	Cloth, yards	13, 375, 436	£891, 697
	Yarn, pounds	3, 476, 747	186, 254
	Total value		1, 077, 951
1770..	Cloth, yards	20, 560, 754	1, 542, 057
	Yarn, pounds	3, 742, 719	200, 503
	Total value		1, 742, 560
1780..	Cloth, yards	18, 754, 221	1, 250, 387
	Yarn, pounds	4, 745, 328	254, 219
	Total value		1, 504, 606
1790..	Cloth, yards	37, 466, 133	2, 499, 841
	Yarn, pounds	3, 536, 064	189, 437
	Total value		2, 689, 278
1800..	Cloth, yards	35, 890, 050	2, 394, 445
	Yarn, pounds	1, 366, 512	73, 207
	Total value		2, 467, 652
1810..	Cloth, yards	37, 165, 039	2, 478, 528
	Yarn, pounds	1, 534, 512	82, 206
	Total value		2, 560, 734
1820*.	Cloth, yards	43, 613, 218	2, 681, 251
	Yarn, pounds	621, 936	51, 268
	Total value		2, 732, 519

The greatest quantity of cloth exported from Ireland, in any one year, within the above-named periods, was 56,230,575 yards in 1817; and the least quantity, 188,000 yards, in 1701.

The greatest quantity of yarn exported in a year was 4,745,328 pounds, in 1780, and the least quantity, 513,296 pounds, in 1823.

*All goods shipped from Ireland subsequent to the year 1825 were placed under the regulations of the coast trade, and were exempt from entry at all ports of Great Britain. Consequently, no exact accounts of the quantities nor of the values of the linens shipped from the island, except to foreign ports, have been kept. Hence, at the periods since 1820, only the foreign exports are given, incorporated in the returns of the United Kingdom.

Exports of flax-seed, raw flax fibre, tow, and the amount of fabrics and other materials resulting therefrom, from the port of Belfast to Great Britain and foreign ports, in 1860.

Articles.	Denominations.	Quantities.
Flax-seed	Bushels	20,844
Linseed cake	Tons	93
Linseed meal	Tons	89
Flax fibre	Tons	5,214
Tow	Tons	1,206
Waste	Tons	1,704
Thread	Packages	2,509
Yarn	Pounds	3,595,200
Tissues	Packages	65,613

THE CULTURE AND MANUFACTURE OF FLAX AND HEMP.

BY O. S. LEAVITT.

The comparative neglect in this country of the culture of both flax and hemp has often excited surprise, particularly as our climate and soils are so favorable to the growth of these staples. We are often exhorted to grow these fibres to be shipped abroad, and manufactured by people more highly favored than we are with money, skill, taste, genius, &c., to be returned to us; and much eloquence and learning have been employed in attempts to convince our people that this is their true policy. It has generally been supposed that we could not do this for ourselves; that there was some mystery connected with the manufacture of linen, ropes, and twine, that we Americans had not sufficient genius to unravel; that perhaps our food or living was too cheap, somehow requiring goods made from the products of our own fields to be sent over sea and manufactured where food was dear and living so much more expensive that the masses are brought to the brink of starvation; or that our people are not yet poor enough for our nation to become great, and powerful, and glorious, like England, by manufactures; as though a nation could become thus great, and command the commerce of the world, only by the poverty of its people. While England, Scotland, and Ireland have about one million of spindles employed in flax-spinning, and a capital of more than $40,000,000, we have about 12,000 spindles, and only $849,836 invested in the business. With some persons this affords evidence of our inability to manufacture flax in competition with England and Ireland. This kind of argument was fallacious in reference to the manufacture of cotton when it was introduced by Slater, in Rhode Island, and experience may prove it so in relation to flax and hemp.

The name which naturalists have given to flax, *Linum usitatissimum*, a plant of the greatest usefulness, shows the high estimate that they placed upon it. It has not unfrequently, in former years, commanded the special attention of kings and statesmen in various countries. The English, under several former reigns, made it the subject of various acts of Parliament; some, as under Henry VIII,

requiring its cultivation under penalties; and others offering bounties, either on its manufacture, or the exportation of linens. Several of the American colonies, before the revolution, encouraged the growth and manufacture of flax by legal enactment. But since the encouragement of industry by bounties has been found to be impolitic, (except in fisheries,) and since the new doctrines were promulgated, and quietly acquiesced in, that "the people should take care of themselves, and the government take care of itself," any facts or arguments touching the industry of the inhabitants, it is supposed, must be addressed either to the people themselves, or to statesmen in their individual capacity. The *culture* and *manufacture* of flax and hemp are so intimately connected that it were useless to treat of either the manufacture or culture separately, since farmers will not grow flax without a market, nor capitalists engage in the manufacture of fabrics without a reasonable certainty of a supply of the raw material. Thousands of tons of flax straw have been thrown out as waste at the west for several years past, where flax is grown somewhat extensively for the seed alone, while very little capital has been drawn to the manufacture of the fibre in any way. It is difficult to account for such apparent indifference to a branch of manufacture so important, while for a considerable portion of time other manufactures in which many millions have been invested have been in a languishing condition. This great neglect of flax manufacture in this country, where our hot and dry summers would seem to render linen so useful and inviting, and where the raw material can be procured in the greatest abundance, can be accounted for perhaps from the fact that a great variety of *notions* prevail as to the best modes of manufacture, many of those who have all their lives been engaged in the business entertaining views and theories so opposite in character as to lead persons who might otherwise have engaged in such pursuits to seek railroad and other similar securities as preferable. The writers on these topics, too, besides advocating views entirely antagonistic, have thrown over the subject a kind of mystery that has been ill calculated to lead capital in this direction. The subject of flax manufacture has been somewhat like that of political economy—the more it has been discussed, the less has it been understood. The writer who shall succeed in so arranging all the important facts in regard to flax and hemp growing and manufacture, reconciling all the apparently conflicting views and theories, divesting the subject of its extraneous materials, mysteries, and difficulties, so that the whole matter may be readily comprehended by any one disposed to investigate it, will be indeed fortunate. An humble attempt will now be made in this direction. The recent disturbed state of affairs in the cotton-producing States gives more than usual importance to this question, as cotton may become not only much enhanced in price, but more difficult to obtain. Then the number of persons is greatly increasing who would greatly prefer, other things being equal, to use these fabrics made of materials produced by freemen. Linens are admitted to be intrinsically superior to cotton goods for most purposes, more especially for all *heavy* goods, and which now require far the greater quantity of cotton. If we are compelled from any cause to cast about for a substitute for cotton, the question so often mooted, whether flax fabrics can be produced so cheaply as to compete successfully with cotton goods, assumes immense importance, not only to this country but, throughout the world.

The agricultural interest is here affected; a greater variety of products is needed. As flax flourishes in all climates and soils, and hemp on all soils that will produce good Indian corn, these staples can hardly be expected to bring so high prices as to be with the farmer a speculation, like cotton, but, like other farm products, will bear some reasonable relation to the cost of production. In this several millions of farmers are interested, against about 250,000 cotton planters. Then it is a question that may, perhaps, assume importance with the cotton planter, if, as appearances indicate, cotton shall be produced in other countries cheaper than he will be inclined to produce it, as flax will grow as

well at the south as at the north. It is profitably grown by the side of the cotton fields of Egypt, as well as in the hyperborean regions of Russia. Then, it is not impossible that the vast expenditures to which we, as a nation, have been led into by our present difficulties may lead us, as a people, to the exercise of a judicious economy, and that the imports of from twelve to fifteen millions worth of linen, and about two millions worth of cordage, which we could at least manufacture at home as advantageously as we do cotton goods, may be looked upon as unnecessary. Our citizens consume annually about two yards of linen each, mostly imported from the British islands, while the nations of the European continent act, it is believed, with more wisdom, importing from thence only about one-thirty-eighth part of a yard per head. Those nations very selfishly prefer giving employment to their own people, not choosing to beggar themselves for the benefit of the British poor. The people of the continent do not deprive themselves of linens, as some might possibly infer from the small amount of their imports; but immense quantities of linens are there manufactured, mainly by the old, well-known hand methods, not only from flax, but from hemp. Indeed, their consumption of cotton goods is comparatively very small. In the British islands it is estimated that more than one million of the population find employment in connexion with the flax manufacture, and five millions with that of cotton. British statesmen have not always deemed it beneath them to consider well those matters connected with the employment of the people. They have thought it better to have them engaged in productive labor than to support them as paupers. The time may not be distant when such matters will deserve attention here. The number of those now out of employment in this country is greater than many would be willing to have known. The mere politician may not regard such trifles, but the true statesman will consider them. Then, these things have so much to do with national wealth, and may affect materially the balance-sheet of the Secretary of the Treasury.

Our exports of cotton may fall off, and we may desire to supply its place with something else. Is it not possible that we may, ere long, export flax or hemp fabrics? It has been carefully estimated that if one-sixteenth of all the cultivated land in the States north of the cotton-growing States were in flax, it would produce an amount of linen goods or pure fibre equal to the whole cotton crop of the United States. This would be at least four times the amount of the cotton exports, and, consequently, one-fourth of this amount would equal our present average cotton exports; but this would require much time and vast expenditures.

Our cotton manufactures, in which there is now invested about ninety-four millions, once had a beginning. Notwithstanding the high price of labor here, as compared with European countries, we have succeeded in manufacturing cotton goods so as to defy competition, even without protective duties. There is no good reason why we may not succeed as well with flax and hemp. Our cheap lands and, consequently, cheap food—our more extended education and greater inventive skill—our free institutions and moderate taxes—would certainly seem to favor manufacturing industry. It is true that the glorious millenium of a certain class of capitalists has not arrived, when the people are at the point of starvation, and are willing to work for ten cents a day, (and it is hoped that day may be long deferred;) but it is worthy of serious consideration with all capitalists and practical men whether as good dividends may not be made here at manufacturing, at our better rate of American wages, with our cheaper raw material, and other advantages, as are made by manufacturing capital in Europe with wages at their present low rates. Manufacturing industry has made England what she is; her statesmen, capitalists, and financiers have been able by this means alone to make London the centre of the commercial world. To London the whole world is indebted, since exchange on that metropolis is everywhere at a premium. All must go there to sell as well as to

buy. England imports her flax, hemp, cotton, and other raw materials, from all other countries duty free, but is careful to sell to those countries so much more than she buys as to make a specie balance in her favor. Sometimes she urges her trade upon other nations by military force, as in China. As a general thing, practicing enormously high duties, she preaches free trade to other nations. She sends her agents to induce us to send our flax to her,* and she will manufacture the best for herself, sending the choicest linens to the London market, plainly done up with a strip of blue paper, secured by a plain piece of twine, and sending us the inferior kind, decorated with an abundance of gilding and trappings. Her colonies are valuable to her almost solely on account of their consumption of her manufactures, and she seems to think the United States were made only for this very thing; and so long as we shall continue to buy her goods, we shall be, to all intents and purposes, as loyal colonies as we were before the revolution.

Now, these things are not a cause of complaint on our part. They present a policy which has been devised and persistently pursued for years by men of the greatest human sagacity and far-reaching financial wisdom, and should lead us to ponder well whether much of it is not worthy our imitation as a nation. If it is the true policy for an individual to produce as much and buy as little as he can, the like policy would seem to be indicated for a nation, a state, or a community. There are persons who believe that in England and Ireland, where not one farmer in twenty owns the land he tills, the flax-grower can pay an annual rent of from $20 to $40 an acre, and produce flax so cheaply that our farmer on his cheap lands cannot successfully compete with him. Others seem to think that Americans can manufacture cotton, wool, locomotives, and almost anything else successfully, but must fail in manufacturing flax, though the material can be produced everywhere in abundance, and so cheaply that flax straw enough to make a pound of linen costs only half the average price of a pound of cotton. With such persons it would seem almost useless to attempt an argument in behalf of this branch of manufacture. Capitalists, in casting about for investments, may find hope in investigating this subject. Among those who have invested more than a thousand millions in railroads in this country, with frequently unsatisfactory dividends, some may find a better prospect in manufactures. The many failures in cotton, wool, and flax manufactures heretofore will not deter those who have a disposition for investigation from seeking the causes of those failures, and perhaps risking something, by the aid of their own better judgment, under more promising auspices. The progress in a new line of trade must almost necessarily be slow, and perhaps it is well it should be so. To build factories enough to manufacture as much linen as is now made in the British islands, with a capital of about forty millions of dollars, and using annually about two hundred millions of pounds of flax, equal in weight to about half a million bales of cotton, would tax the available surplus power of all the machine shops in the country perhaps for the next ten years. The business might, of course, be expedited by building more machine shops, and by procuring and instructing a far greater number of machinists and other artisans than we now have. But European experience has shown that, rapid as the increase of this manufacture there has been, the demand has not been so far behind the increased supply as materially to reduce the prices of the fabrics; and with a very slight reduction in the prices of linen goods, and with the advantage of having them manufactured more generally in this country, a largely increased demand might be reasonably expected. During a winter spent in the British islands a few years ago, for the purpose of investigating everything possible in relation to flax and manufactures, the writer did not see either a sheet, towel, table-cloth, or a piece of ticking made of cotton all linen—and but very few

* Lecture on Flax, &c., before the New York State Agricultural Society, by John Wilson, F. R. S. Saxton, New York, 1853.

cotton shirts. But very few cotton garments are ever found among the German or other European immigrants that come to this country, showing that, notwithstanding the rapid increase of the cotton manufactures since the introduction of Arkwright's improvement, about eighty years ago, the United States alone among civilized nations has to a considerable extent abandoned the ancient habit of using linens.

This also leads to a doubt whether there is really so much difference in favor of cotton goods in the cost of production as many suppose who have been in the habit of purchasing their linens made abroad, and which have very naturally paid several profits to the sundry dealers through whose hands they have passed from the European producer to the American consumer, to say nothing of duties, insurances, freights, and the other numerous charges to which transatlantic goods are subject. Among those practically engaged in the linen manufacture, the writer frequently heard the expectation expressed that in this age of science and discovery some new and improved machinery and processes would be ere long invented, by which linens could be so cheaply manufactured as to compete successfully in price with cotton goods.

In this article an attempt will be made to explain the causes of the failures which have so often attended the attempts to introduce new and cheaper processes of manufacturing flax and hemp, especially without the rotting process, and show how the difficulties under which they labored have been surmounted. It will show that linens ought not to exceed the cost of cotton at average prices; that linen can be made of hemp, which can be made a profitable crop in all the middle and western States; that cordage can be made profitably from flax as well as hemp; proofs of a demonstrable character will be furnished that the general impression that flax is an exhausting crop is entirely groundless, and has no foundation except with those farmers who are so far behind the times as not to use rotation in their crops; that, if flax and hemp are to be purchased in the straw by the manufacturer in the unrotted condition, to be worked either way, rotted or unrotted, factories must be located near where these articles are grown, and, by being scattered over the whole country, will greatly benefit the agricultural interests, and be more generally advantageous to the public than when concentrated in the so-called manufacturing cities or districts; good reasons will be given for the belief that many millions of capital, judiciously employed in the flax and hemp manufactures, will pay enormous profits for many years to come, finding its only parallel in the magical accumulation of wealth in the early days of the cotton manufacture, under Arkwright's invention, in England; that vast ignorance and prejudice, with tricks of trade, have tended to shroud the subject in mystery, when nearly everything connected with it should be and can be made plain to the most common understanding.

The history of flax, and how Moses and Homer, Columella and Pliny wrote of it, can be found in almost any of the books of reference, and needs hardly to be given here. The true nature of the plant, its organic structure, &c., are of the greatest importance, since ignorance of these has led to the greatest errors.

Flax fibre or lint, of which linen is made, is the inner bark of the plant *Linum usitatissimum*. This bark or harl is covered with a thin cuticle. The fibres are united and enveloped in a glutinous substance, sometimes called vegetable albumen, being chemically almost identical with the white of eggs, and when dry it is not unlike hard glue, but only partially soluble in water. It is a kind of cement, connecting together the fibres, and also connecting the harl or bark to the interior woody portion, called the boon, and which, when the flax is broken out, is fractured to pieces, and called shives. This substance, which encloses the fibres of flax and hemp, is, in its natural state, the most destructible of all substances, warmth and moisture inducing rapid fermentation and decay. This property alone has been the cause of failure in more than one attempt to

work flax and hemp in the unrotted condition, especially in the manufacture of cordage; but a remedy has been found in the use of chemical antiseptic substances, a process called "*kyanizing*," and which has been tried in the preservation of timber as well as of ropes. The ultimate fibres of flax and hemp are very short, only from one to two inches long, being lapped or shingled upon each other in the progress of growth, forming long hair-like filaments, which latter many have mistaken for the ultimate fibres themselves. Each filament is a bundle of extremely fine short fibres, lapped upon each other, as before stated. This can easily be demonstrated by any one who will moisten upon the tongue a fine long filament of flax. When exposed for a few moments to the action of the saliva the points of the short fibres may be seen starting from its whole length when gently drawn through between the thumb and fingers. It is a curious fact, though contrary to the general belief, that these fibres are equally fine, so far as can be ascertained by the use of the microscope, whether of the finest flax or coarse flax, such as is produced in this country solely for seed, or the coarsest hemp. The difference between the finest and the coarsest flax or hemp is only this: in one case the filaments are so firmly cemented by the glutinous matter as to be separated with difficulty, while in the other they are not so cemented, a difference arising from a different manner of growth or preparation. This incrusting matter, which envelopes and cements the fibres and hair-like filaments of hemp and flax, constitutes the chief difficulty in their manufacture. In the first place, the cohesion which it causes between the harl (skin of flax) and the interior, woody portion, is so great as to render it extremely difficult to separate them by any hand process, and it has been always considered indispensable until quite recently to expose hemp or flax straw to the action of the weather, called dew rotting, or so immerse it in water, called water rotting, in order not only to cause an easy separation of the bark or harl from the boon, but to disengage the filaments of the harl to some extent from each other. This labor of rotting or watering is so considerable, and requires so much care and skill to prevent the action of fermentation in the water, or *erenea causis*, slow decay, in the dew rotting process, from injuring the fibre itself, as to constitute the chief drawback to the business of their cultivation. Indeed, it is generally admitted to be impossible to conduct these processes so perfectly as not to injure and weaken some of the fibres, or to leave some not sufficiently rotted for the purpose intended, to wit: the ready separation of the harl from the woody portion of the stem in the operation called breaking. This rotting process, by which the gluten is partially decayed, is very properly named, and much of the flax and hemp that has gone through the process may not only be called rotted, but *rotten*. This incrusting matter, which causes a strong adherence of the harl to the boon, constituted nearly half the weight of the harl when separated from the boon in the unrotted or natural state, but little more than half of which is soluble in water. The remainder, principally gluten, is soluble in alkaline solutions, and imperfectly in soap water. Gluten seems to be the cement of the textile fibres, which it has always been found so difficult to remove. By the rotting processes which have so long been in vogue, only a small portion of these albuminous azotized substances are removed, what remains being slightly changed in character, more weak and friable, but still so strongly adhesive as to require much manipulation, heckling, breaking, &c., to cause such a separation of the filaments as to bring them into a condition suitable for spinning into fine yarn. These operations rupture many of the filaments, making what is called tow, but no such substance as tow naturally exists in either hemp or flax, unless a few of the shorter fibres can be so called, which *run out* at the lower leaves or joints. These textile fibres in the natural state are white, but become somewhat stained by the extractive matter in which they are enveloped in the wet-rotting process to which they are generally subjected. The incrusting matter about the fibres renders the bleaching of linen fabrics difficult, and by being, as it

were, twisted up in the yarn in spinning, greatly increases susceptibility to the corrosive action of chemical agents upon the fibre itself in the process. Indeed, it is generally admitted that the bleaching of linens without injury is almost impossible. The proportion of this glutinous incrusting matter remaining on the flax and hemp fibre in the condition in which it is generally received by the manufacturer frequently reaches 35 per cent. of the whole weight, about one-third of which is lost in the dry process of manufacture, and in the manufacture of linens the remaining two-thirds are lost in the process of boiling the yarns in alkaline solutions, and in the subsequent processes of bleaching. In hemp the proportion of this waste is somewhat greater than in flax. These textile fibres are cylindrical in form, straight, infinitely fine, lapped upon each other in the hair-like filaments. They cannot be *split*, as was empirically taught some years ago, in attempts to make flax-cotton, but they can be separated by dissolving and removing the matter by which they are connected. They have this curious quality: when a portion of fine flax has been wet, as when washing it out with soap and water, and dried, the fibres adhere as firmly together as if they had been starched. In the common language of workmen, a hand of flax thus wet and dried again "is as hard as a board," and in any attempts to open out the fibres, as with a heckle, most of it will be ruptured, and become like tow, and what remains will be found to be harsh and undesirable, many of the fine filaments being united together. This peculiar property of flax fibre has of itself caused the failure of several attempts to improve the flax manufacture, but the difficulty has recently been easily surmounted. To this point allusion will be made hereinafter.

A concise statement of the usual methods of manufacturing linen will be necessary to fully understand the necessity and value of the more recent and improved methods, and to enable the reader to form an intelligent opinion in relation to the question whether flax can be made to compete successfully with cotton; whether linens can be made, as has been claimed, as cheap as cotton goods.

It has been seen that flax, as well as hemp, to be fitted for the usual modes of manufacture, must be rotted, and, as a consequence, much of it is rotten as well as rotted. It is selected according to its apparent strength, the easy separation of its filaments, or apparent fineness, its color, the lighter being preferred, and its purity, or cleanness of shives and trash. It is also desired to be of uniform length, the harls parallel with each other, and soft, not harsh, to the feel, and of a bright metallic lustre. The mere growing of flax is comparatively nothing to the subsequent preparation of it to suit these conditions; and so undesirable is this kind of business even to the European, painstaking farmer, and so few comparatively have been found to succeed in preparing flax properly for market, even when they have grown a good crop, that, of late, it is somewhat customary in Europe to employ a kind of middle-men, called liniers, between the producer and the spinner, for the purpose of properly rotting, breaking, scutching, and otherwise preparing the material for the manufacturer.*

In making fine yarns by machinery, the first thing the flax-spinner does is to cut the flax in three or four lengths; this is called *cut line*. For coarse yarns only the full length of the flax is required. The next process is the *heckling*,

* The following from Delano's work on flax, page 6, is in point as to the difficulties in preparing flax for market after it is harvested: "We attribute the failure [to grow flax in England] in great part to the circumstance that with *this* crop the English farmer has too many little details to attend to *after* it is grown. It is more than he can manage himself, with all his complicated affairs, to grow flax and then to prepare it to a proper state to be sold to the spinner. For all these after-processes, too, he has to contend with the difficulty of finding a very great scarcity, if not an absolute deficiency, of skilled laborers. He has to educate a set of men to execute a series of nice and catching work which they have never done, and of which they have not the slightest idea."

sometimes in this country called *hatcheling*. This is the most expensive branch of the flax manufacture, at which only skilled workmen can be employed, mechanics who have learned the trade. The purpose of heckling is threefold:

1st. The separation of the harl into as many fine filaments as possible.

2d. The separation of the shorter fibres or tow.

3d. To equalize and render parallel the filaments.

Most flax passes through the hands of different hecklers, and undergoes repeated operations upon coarse and fine heckles. The operator seizes as much flax as he can conveniently clasp between the thumb and finger of the right hand, and first throws it over a coarse heckle, called a *rougher*, holding the flax near to the centre. If it is *cut line*, eight inches long, he will clasp a little more than three inches in his hand, throwing the other and longer end upon the heckle, and when sufficiently done he turns the flax and repeats the operation upon the other end. This is carefully laid down for another still finer instrument, and so on through a succession of three and sometimes four different heckles of different degrees of fineness; the finest contains over one thousand teeth, each about the size of a common sewing needle and about three inches long. To appearance the operation of heckling is simple enough, but it requires great experience to acquire dexterity. In the upper story of the European establishments for spinning flax by machinery are generally four rows of hecklers, standing as close together as they can conveniently work, from one end to the other; and as these are all mechanics, and not common laborers, their pay-roll would astonish the manufacturer of almost any other description of goods. From the heckling loft the flax, carefully laid up in *hands* as they come from the last heckler, is removed to the preparing room to be passed over drawing and roving frames to be got ready for the spinning frames. The tow goes to the carding room. The first machine in the preparing department is called the spreading frame. The most experienced and faithful girls are here employed. The spreading frame is simply a drawing frame with two feed-cloths travelling slowly towards the machine on which the hands of flax are carefully spread, one hand lapping about half or two-thirds its length on the preceding one. By this machine the flax is converted into the *sliver* or endless form, being drawn down so much in its progress that the quantity of flax on the feed-cloth makes from twenty to thirty yards on the other side of the machine, and which, like slivers of cotton in cotton mills, is deposited into a can, and sometimes both slivers are united in one at the delivery. The drawing operation is the same in the spreading machine as in the drawing frames. On the delivery side of the machine are drawing rollers, not much unlike those in drawing frames used for cotton. Holding rollers are placed back near the feed-cloth, the space between these sets of rollers being governed by the length of the flax, say for long line about two feet, and for cut or short line from six to eight inches, and about the same for the tow drawing. Between these sets of rollers are bars of steel, with gill-pins (needles without eyes) so placed as to reach up through the belt of flax which is passing through the machine. These gill-bars, or fine-tooth steel combs, travel forward at the same speed as the feeding rollers; the more rapid speed of the drawing rollers, as soon as they seize the ends of the flax filaments, draws them forward rapidly. These gill-bars are made to come as close as possible to the drawing rollers, where they are made to drop down and return to take their places again near the holding or feeding rollers, being there brought into position at the right moment by the machinery. The machines now generally preferred are called the *spiral* or *screw-gill* machine. Machines on the same principle are used in the best worsted establishments in this country. The gill-bars are moved forward by having their ends inserted between the threads of a pair of screws lying at right angles with the rollers. Cams on each end of the screws depress the gill-bars at the right moment, by which the pins are drawn down out of the flax; the cams at the same time press the gill-bars

into threads of another pair of screws running in an opposite direction, carrying the gill-bars back again to the place of beginning near the feed-rollers, where the two cams on the two lower screws raise the gill-bars again, inserting their teeth into the belt of flax as before. These machines are complicated, and, compared with cotton drawing frames, are expensive. The slivers of flax are then passed through other similar machines, first, second, and third drawings, the pins being finer and more numerous as the work approaches completion, when, on the *roving frame*, the fine sliver is slightly twisted and wound upon a large bobbin. It has now become roving, ready for the spinning frame. The tow is worked in very nearly the same way, except that it is carded before coming to the drawing frames, and, as the carding engines deliver the tow in the sliver form, no spreading frame is necessary, the slivers being fed directly to the drawing frames in cans, as in the cotton manufacture. The carding engines for tow are much more expensive than those used for cotton or wool, the best having workers and strippers all round the cylinder, and having needle-point steel clothing. This clothing is worth about $3 per foot superficial, and is made by R. Kitsen, of Lowell, Massachusetts. This kind of card is also used for carding hemp tow in the Kentucky bagging factories, where the fabric used for covering cotton bales is manufactured, also for carding hemp tow for bale ropes. The card clothing, of course, varies in fineness according to the fineness of the material worked. The spinning frames for tow and line spinning by the wet process, now almost universally used for ordinary to fine linens, are the same for both, and not much unlike the throstle for spinning cotton, while they cost but little more. On the frames are two troughs the whole length, containing water warmed by steam, through which passes the roving from the bobbins. Two pairs of rollers receive the roving from the warm water; the pair next the trough being of brass, fluted, so as to hold the wet roving as firmly as possible; while the front pair, running about sixteen times faster than the others, draws out the short fibres from the flax filaments, the glutinous matter being softened by the warm water so as to allow them to slide out easily, not broken off or stretched out, as many suppose; and a fine, attenuated thread is the result. As these pairs of rollers are very close together, adjustable from two to three inches apart, according to the material or the fineness of the yarn, *no fibres can be in the yarn longer than the distance between these pairs of rollers.*

Any one can test this for himself by taking a thread of Irish linen, and taking out the twist, and gently rubbing the fibres apart: no fibre will be found more than three inches long, thus demonstrating that the common impression as to the length of fibres in linen goods, except such as are made by the old process of hand spinning, is erroneous.

The glutinous matter being softened by the warm water, and the ultimate fibres of the flax being very short, as before stated, they are easily drawn out, as by this admirable arrangement the twist from the spindles running up to the front rollers perfects the thread the instant the drawing operation is completed. It may be here stated that the lower front roller is brass, fluted, and the top roller of wood or gutta-percha, also fluted. The top rollers are held down firmly with levers. The throstles, as with cotton, are generally attended by girls, and each can manage as many spindles in spinning flax as in spinning cotton; but as linen requires less twist than cotton, and since yarn of the same fineness weighs about twenty per cent. more than cotton, she can spin more in weight and in length of the former than the latter.

It will be seen, then, that the great expense of producing linen as compared with cotton does not lie in the spinning, nor, since power looms have been introduced for weaving linen, does it lie in the weaving, the cost of spinning and weaving both flax and cotton being about the same. The main part of the increased cost, then, must be looked for in the production and preparation of the material; and here is to be found the field in which attempts at improve-

ment will be most likely to succeed. Flax yarn, whether of tow or linen, is reeled off on a reel 2½ yards around, 120 threads in a cut or *lea*, and the fineness is counted by the number of leas to the pound; thus, 20 to 30 lea yarn is suitable for sheetings; 50 to 60 lea for shirtings; 80 to 100 for pocket-handkerchiefs; while the higher numbers, from 200 to 300 lea, most of which is spun by hand in the old way, go to the fine thread-lace manufacturers upon the continent.

As soon as linen and tow yarn made by the usual mode from rotted flax is reeled, it is boiled for several hours in a strong alkaline solution, in order to remove the remaining glutinous matter which has escaped being crumbled off during the several severe processes through which it has been made to pass in the dry state, such as breaking, scutching, heckling, and frequently beating and brushing, and carding, passing through fluted rollers and among tens of thousands of fine, needle-pointed gill-pins in the preparing machine, during the whole course of which large quantities of dust have fallen, indicating the friable nature of this great enemy of the linen manufacture. In boiling, the yarns lose about 15 to 20 per cent. of their weight. It is not a little singular that the flax-spinner should be at so much pains to combat this cementing substance among the flax fibres during the whole course of preparation by manipulation and machinery, when finally nearly every vestige of it is removed by a little boiling in soda ash water!*

It may now be interesting, and perhaps not altogether unprofitable, to notice some of the numerous attempts which have been made to reduce the great labor and expense of manufacturing flax.

In 1812 Lee took out a patent in England for a machine and process for breaking and working flax straw in the natural or unrotted condition; and so important did Parliament consider the invention, that the peculiar privilege was accorded to the inventor of having his specification filed for seven years in the secret archives of the government. This plan contemplated making linens entirely by the dry process. The Irish linen board expended £6,000 in their endeavors to introduce it into the flax districts. In 1817 the same was patented by Hill and Bundy. Other similar attempts were made on the continent, and all failed for the following among other reasons:

1st. The breaking machines were very imperfect; greatly inferior to those which have been of late worked with better success in this country.

2d. The flax, broken out and cleaned in the most perfect manner, in the unrotted condition, is coarse, harsh, and totally unfit for fine yarns, on account of the great cohesive force of the glutinous matter connecting the filaments so firmly that no heckling, brushing, or other mechanical means, can separate them sufficiently for fine numbers. What may, in this condition, appear to be but a single filament, will, upon close examination, be found to be a bundle of filaments cemented together by the incrusting matter.

3d. It was found that in attempting to divide the harls sufficiently many were ruptured, making a far greater proportion of tow than by the rotting process, while the tow was of a very inferior quality—merely wide harls, with more or less adhering shives. Many harls were torn off abruptly, making what the spinners call "stumpy ends;" and the whole very harsh, only suitable for inferior rope yarn.

4th. By neglecting, as many did, to boil their yarns or goods properly in an alkaline solution, the azotized incrusting matter, on exposure to moisture, would cause the goods to mildew and decay more rapidly than when made from rotted

* While most of the flax grown in Europe is still manufactured by hand in the old way, machinery exists in the British islands to the amount of about 1,100,000 spindles; France, 400,000; Belgium, 100,000; Holland, 6,000; Russia, 50,000; Austria, 30,000; Zoll-verein, 80,000; Switzerland, 10,000; United States, 12,000.

flax; but this was not the main cause of failure in working unrotted flax, as many have alleged.

Many plans have been devised for dissolving out the glutinous extractive matter of the straw by means of chemical substances, such as acids and alkalies, and thus doing away with the tedious and noxious process of rotting. Both acids and alkalies have this property to a certain extent. A few years ago the public attention was called to a process, patented both in this country and in Europe, by Claussen, for making from unrotted flax a substance resembling cotton, and which he called "flax-cotton," and since, by some American manufacturers, called "*fibrillia*." This was but a revival of an old invention, or, rather, of several old inventions. The same thing was attempted by sundry persons, with indifferent and varying success, from 1775, by Lady Moira, down to 1811, by several individuals on the continent. These persons all used an alternation of acids and alkalies, as Claussen did, and as bleachers always do. These things occupied the attention of Gay, Sussac, and Berthollet. It was the latter who made the discovery that all fibres of hemp or flax are equally fine. He says, "Whether the finest flax or the coarsest hemp tow be employed, filaments equal in their fineness are obtained." This idea of using cottonized flax, notwithstanding it has been so often abandoned, is again exciting considerable interest in this country, and, as some improvements are claimed for machinery and processes, it is possible it may succeed. The scheme is generally condemned by practical men, frequently from insufficient causes, and often from prejudice. Many a good thing has been abandoned for want of skill and perseverence. Navigating boats by steam had been tried and abandoned long before Fulton succeeded.

We have seen that the fibres of flax are not much longer than those of cotton of the ordinary kind. Some very valuable facts have been brought out, in the various attempts to make flax-cotton, which may lead to important improvements in the manufacture of linen, even if the attempt to make a material from flax to work on cotton machinery is found unsuccessful:

1st. It has been found that there is no difficulty whatever in dissolving out the glutinous matter and setting the fibre free.

2d. That the flax can be economically and rapidly broken out in the unrotted condition.

3d. That the fibre is far superior when prepared from the natural unrotted straw—stronger and more easily bleached—than when the material has been through the rotting process.

4th. That the cottonized flax can be produced at less cost from our coarse American flax, such as is grown in many parts of the western States almost entirely for seed, than the average price of cotton.

5th. That flax-cotton is a far better material than cotton to combine with wool for tweeds and other similar goods, for common wear, rendering them stronger and more durable.

6th. It can be spun on cotton machinery, when combined with cotton to the amount of one-third to one-half, the goods appearing much like cotton goods, taking color well when printed, &c.

The efforts made in this direction for the last few years certainly promise better than any of the numerous efforts heretofore made. But men will doubt whether flax-cotton can be produced as cheaply as has been alleged. A few figures will enable any one to see that this is by no means an impossibility. From eight to ten tons of dry flax straw, in the unrotted condition, will make a ton of flax-cotton, or pure fibre, divested of the woody and glutinous matter. This, when cut with a cradle, scythe, or mowing machine, as is generally done at the west, where so much flax-seed is produced, can be purchased and delivered at $5 per ton—$5 \times 10 = \$50$ per ton, or $2\frac{1}{2}$ cents per pound, as the cost of material; then we have a margin of about three times the cost of the raw

material to be expended in factory labor before bringing the cost of flax-cotton, or *fibrillia*, up to the average cost of cotton in past years—about 10 cents per pound. If pulled flax is purchased at $10 per ton—the usual price at which it is sold in the middle States, and some, also, at the west—the first cost of the material would be five cents per pound; still leaving what is claimed as an ample margin for the labor required, without bringing up the cost to the average price of cotton. Machines are now used for breaking out the unrotted flax, at the rate of two tons of straw a day, tended by a man and two boys, and, in some instances, by two men. The machines cost from $400 to $1,000, and are made to break the straight, pulled straw, as desired, saved, as pulled flax generally is, in small bundles, or it will break the mowed, tangled flax as well. The breaking of unrotted flax straw enough to make a pound of either flax-cotton or linen goods costs only about one-half a cent; then water, which takes out the greater portion of the extractive matter, is not an expensive chemical, nor are acids and alkalies, used for the remainder, of a very costly description. The machinery used for parting the fibres to the proper length for drying, picking, &c., are not, or at least they need not be, of a costly description, nor need there be any necessity for the employment of much skilled or expensive labor. The bleaching in the fibre is a very simple matter, requiring little skill beyond what may be necessary in the arrangement of the fixtures so as to be convenient and save labor. There may be valuable patents for some of the machines and processes used in the manufacture of flax-cotton, but these are certainly not indispensable to the making of this article, and that cheaply. The process is an old one of cottonizing flax; and among the numerous descriptions that may be found for accomplishing this object, any person conversant with machinery and processes used in working other fibrous materials, who understands correctly the nature of flax fibre, need not go far wrong in his attempts to manufacture this substitute for cotton.

That it can be made, and that it can be advantageously used for some purposes, there is no question. Doubts may reasonably exist whether it can as a general thing be advantageously used for the finer articles of goods, but there can be no question that for some descriptions of coarse goods, such as sacks, osnaburgs, heavy sheetings, &c., for which the greatest bulk of the cotton crop is used, it is decidedly advantageous to use an admixture of flax in some proportion, rendering the goods, if not fairer in appearance, at least stronger and more durable. As to the economy of its use, that must depend upon the price of the flax preparation as compared with cotton, and upon the effect that the flax admixture may have upon the price of the goods in the market. When cotton is high, there is no question but its use would generally be admitted to be economical, if it could be readily and cheaply procured. But the great difficulty in the way of the successful introduction of *fibrillia* as a substitute for cotton to any considerable extent will be found in this: there is too little margin of profit, as a general thing, counting the average price of cotton, say ten cents per pound, to induce capitalists to engage in the business of preparing it. In this view it is pertinent to inquire, Would it not be better for those engaged in cotton spinning to make preparations to manufacture, or rather prepare, their own flax-cotton? If it can be produced at eight cents, this generally would amount to a saving of importance to a cotton factory that could use it or not, according as the price of cotton might be, while the great uncertainty as to the price of cotton would operate against large investments in the manufacture of flax-cotton alone, with the average chances of a profit of only two cents per pound. Capitalists need hardly to be told of the advantage that would arise in not requiring the use of so large an amount of what is called *running capital*, by preparing and using as much flax-cotton as they can, since the first cost of the raw material, say from two and a half to five cents per pound, and which can be bought of the neigh-

boring farmers from time to time as wanted, increasing only their weekly or monthly payments for factory labor.

One great difficulty in the way of the introduction of this new material is the prejudice of workmen against it, and their great dislike to changes. Innovations occasion some trouble, and require occasional alterations or new adjustments of machinery. These persons are often consulted by the employers in regard to the feasibility of proposed changes, and unless the changes are suggested by themselves are almost universally condemned. The failure of previous attempts will be dwelt upon in such cases with emphasis.

Claussen, by *cutting* the flax, instead of *parting* or *sliding out* the short fibres, as would be indicated by the nature of the material, produced an article with *stumpy ends*, and poorly adapted to spinning. American improvements, particularly under the auspices of Mr. Allen, of Boston, have remedied this defect, so far, at least, as to make fair goods, while those from Claussen's flax-cotton were worthless.

But there is and always must be a vast difference in the quality of flax-cotton. That made from clean heckled flax will always be far superior to that made from the unheckled flax, called by the workmen "tow and tier." Very fair-looking flax-cotton can be made from tow alone, that may answer well for combining with wool or for making bags or sacks, but the few shives remaining in it, and the little knots occasioned by the parts of the flax plant where the branches are united to the stem, will render it unsuitable for fair shirtings. Then much will depend upon the kind of flax. If of good length and the stem without many branches, as when sown thick, the flax-cotton will be far superior to that from short, thin-sown, *branchy* flax. Many farmers in this country, who grow flax mainly for the seed, sow only about half a bushel of seed to the acre, and, sown thus thin, each plant throws out numerous branches, which spread out like an umbrella. In Europe, where generally the lint is the main object, from two to three bushels of seed are used, the flax branching very little, and only near the top. This produces not much more seed, but a larger amount of straw, and consequently more lint, while it is of a superior quality, being without those tangled, knotty fragments so liable to be made from the flax near the places where the branches put out from the main stem. In the early part of the present century, in attempts made near Brunswick to introduce goods made from cottonized flax, it was found that fustians made from it could not be distinguished from those made from cotton. Beekman, who relates this fact, makes no mention of the comparative strength and durability of the flax fustians, but the fair presumption is that they were superior. And here it may be remarked that the English show their good sense in the very general use they make of this comfortable and very durable fabric; and should the flax-cotton fabric come into general use for the common wear of work people here as well as in England, both the wool and cotton markets would be greatly affected. The goods made of the cotton and flax mixture have apparently none of the characteristics of linen, but only those of cotton goods. They are not necessarily linens because flax enters into their composition, as many seem to suppose. The fibres of flax and cotton combined do not lie as compact as flax fibres alone, nor do the goods have the brilliant, lustrous appearance of linens. Some of the prints that have recently been made of this combination at the Tremont Manufacturing Company's works, near Boston, have slightly the appearance of *delaines*, as if wool, rather than flax, had been combined with the cotton. Should these goods be found more durable than all cotton, and should be found to sell as well in the market, there can be no good reason why they may not come so rapidly into use as to reduce the demand for cotton at least one-half in a very few years, and the world receive the great benefit arising from a reduction of the price of cotton to something near the cost of production, like other agricultural products, six to seven cents per pound, instead of being a speculation

of such gigantic proportions, bringing to the comparatively few cotton-growers profits so enormous as to render to them the very existence of the government itself a very subordinate affair.

The question is often asked, If it be true that flax can be so easily divested of its glutinous matter and parted short enough to be spun on cotton machinery, making goods not exceeding cotton goods in cost, why may not linens be more cheaply produced than heretofore, by some similar methods of treatment? This has already been done, and machinery and processes have been invented in this country by which it is claimed to have been demonstrated that linens can be produced as cheap as cotton goods, at the average price of cotton. Why should they not? It has been seen that enough unrotted flax straw can be bought to make a pound of linen or flax-cotton goods at from one-quarter to one-half the cost of a pound of cotton, and that, in the manufacture or preparation of flax-cotton, the glutinous matter, which it has always been supposed could not be removed but by the noxious, troublesome, and expensive rotting process, can be so easily removed as to bring the prepared fibre within the average cost of cotton. Besides, it has been shown that the difficulty which has hitherto existed in the way of breaking the unrotted flax, so as to separate the lint from the woody portion, has been removed; that the coarse flax has a fibre as fine as the finest; that the great obstacle which, in the early part of this century, baffled the attempts to refine the fibre by wet processes, after being broken out and before spinning, in relation to the flax drying stiff and hard, has been removed; and that the flax fibre for making linen requires to be but little longer than the fibres in flax-cotton.

We have seen that the *spinning* and *weaving* of linen are no more expensive than the spinning and weaving of cotton, and that the bleaching of goods made of refined flax fibre, like that in flax-cotton, is reduced to the simplicity and cheapness of the bleaching of cotton goods, and that the fibre is less injured than when the glutinous matter is twisted up in the yarn among the flax fibres. It has been seen that the great difference between the cost of production of linens and cotton goods, if flax can be used in the natural or unsettled state, must be found, if any difference there be, not in the cost of the raw material, which is in favor of linen, nor in any of the processes subsequent to the roving formation, but only in the *preparation* for the spinning frames. It is evident that in preparing the flax for linen it is desirable to have the fibres or rather the filaments parted in such a manner as to have as many as possible from six to eight inches long, and in all other respects like good flax-cotton, clear of shives, fine, clear of glutinous and coloring matter. It will not certainly be claimed that it will be more expensive or difficult to part it so that no filaments shall exceed six inches in length, than it would be to part it like flax-cotton to one or two inches. We have, then, *long flax-cotton* as the first preparation for making linen at a cost not exceeding the other. But this will contain many short fibres, little knots, and impurities that must be removed. Will any one who has ever seen a wool-combing machine in operation assert that this cannot be cheaply done as to save the enormous expense of heckling by the present European mode? It has been found that this can be easily done. By the modes of heckling heretofore used, either by hand or by machinery, each hand or stick of flax, a handful of flax has to be operated upon first one end and then the other. When machines are used, several hands of flax are fastened in *clamps;* and when one end of the hands are heckled, boys take the flax out of the clamps and turn it, so that the other end can be heckled. This vast amount of manipulation is almost entirely saved by the use of a machine which delivers the heckled flax in a can in the sliver form. It has generally been supposed that a machine to heckle tow, or tier flax in the sliver form, could not be made, but American ingenuity has accomplished what European machinists have deemed impossible. It is believed that a full-sized machine, tended by two boys, will do the work

of fifty men at hand heckling, and do it equally well, thus reducing the expense of heckling to a mere trifle. If this machine is found to work with as much certainty and uniformity as is promised by the operations of a small machine, which has been tested in a private manner, the great question is at once settled, that linens can be made at a cost not exceeding the average cost of cotton goods. When we bear in mind that by the present mode of manufacturing linen by machinery there are no filaments or fibres more than three inches long to be found in the yarn, no matter how long the flax filaments may have been at the commencement of the preparing processes, and when we take into consideration the fact that a very large proportion of the fibres in machine-spun linen yarns do not exceed two inches, and many not longer than those of ordinary cotton, it is plain that in the heckling process, separating the tow from the line, all the fibres of these lengths possible should be saved in line, or heckled flax, and that no fibres exceeding two inches should be thrown out with the tow. Now, by the hand-heckling process, or by any heckling machines heretofore used, *no fibres can be saved that do not exceed half the length of the line:* thus, if the flax cut line be eight inches, the shortest fibres saved in the line will be about five inches, and if the flax be cut or *parted* to six inches, the shortest fibres will be about four inches, all the shorter fibres going out with the tow. The tow is of inferior value, as it can make only tow yarn, generally used for coarser purposes and only for fillings. With great labor with what is called *heckling* or *drawing* the tow over again on the heckles, many of the longer fibres of the tow can be drawn out that are as good as the finest heckled line for linens, but it rarely pays for the trouble. Now this new machine which heckles flax in the sliver is so made that the fibres thrown out as tow shall not exceed any length to which the machine may be adjusted; thus, for fine linens, all the fibres would be saved in line exceeding two inches, and if the fibre has been refined and purified and bleached like flax cotton before working, *the tow would be flax cotton* with fibres not exceeding two inches. This might be carded and spun on the wet flax spinning principle and be used for linen fillings, or it may be used as flax cotton for combination with wool or cotton. It is questionable whether this be not the most economical mode of preparing flax cotton: *prepare the whole as flax cotton, parted to, say, six inches; when in the sliver form draw out the longer fibres for linen; the rest is flax cotton.* In this way, too, the American linen, having both warp and filling of heckled flax, will be far superior to the Irish, most of which is filled with tow yarn, saying nothing of that other advantage we might claim of using a material with all its original strength, and which has in no sense become rotted or rotten.

There is a very great similarity in the machinery for working all fibrous materials. Wool, cotton, and flax are all put into the sliver roving condition preparatory to spinning; these slivers are drawn down and formed into roving by processes very similar, especially when combed wool is used. The old Scotch method of working flax is quite similar to that of cotton, the drawing being done by rollers without gill-pins. The carding of wool, cotton, and tow is conducted on very similar principles, and a machinist or workman accustomed to one can soon understand either of the others. By late inventions wool is spun on a throstle, very similar to the throstles used as spinning frames for flax and cotton. There is no more mystery, or there need be no more, about working flax fibres than any other fibres.

But it will be denied that flax can be worked advantageously in any other way than by the old methods, and articles are printed in scientific journals assuming that flax fabrics can never compete successfully in price with cotton goods, and cautioning the public against any such idea "as a delusion." This matter is alluded to not for the purpose of entering upon a controversy, which would be inappropriate here, but for the purpose of illustrating more fully and

clearly than could otherwise be done a subject of more importance to this country and the world, affecting manufacturing industry, than any other that has come up for the last half century. More than ten years ago it was announced in this country that inventions of new machinery and processes had been made by which *linen* could be made as cheap as cotton goods from unrotted flax. Practical men who had heard so often of previous failures in this direction, without considering well whether the obstacles which others had not surmounted were insurmountable, were faithless. They waited, and no practical results appearing, they said, "this too is a failure," not stopping to inquire into the causes, whether from inherent defects in the invention, or from a want of capital, or other causes. Like the knowing ones in England, during a period of over twenty years that was occupied by Arkwright in developing his inventions for spinning cotton by rollers, they thought it could not be done, or others would have done it before, or that he could have done it in less time. When done, perhaps, the marvel will be, as it was then, that men had been so stupid and blind as not to have seen the thing before. It may be useful here to notice some of the arguments or reasons adduced by these writers or speakers who, in their laudable attempts to prevent people from investing their money in foolish projects, assert that linens cannot be made so as to compete successfully with cotton goods. Like most people who attempt to prove a negative, they have to rely a good deal upon assumption. One says this cannot be done, because flax *must* go through certain rotting and other expensive processes; when it may be answered that it *can* be done, because those expensive processes are avoided. Another says linens cannot be cheaply manufactured, because others have attempted to cheapen the manufacturing processes and have failed. To this it may be answered, that the same argument may apply with equal force to any other alleged improvement. It would be well if such persons were to take the trouble to inform themselves of the precise obstacles in the way of the success of former attempts, and whether these obstacles may not have been surmounted. Fielding devotes a chapter to the business of proving that a man can, as a general thing, write better on a subject which he understands than he can on one of which he is ignorant; and from the great amount of ignorance, looseness, and prejudice exhibited by certain writers in pretended scientific publications against the possibility of cheaply manufacturing linens, it may be reasonably inferred that their education has not extended to the study of the chapter of Fielding alluded to. One says that linens cannot be cheaply manufactured "in the present condition of the arts," as though any one could say confidently what the present condition of the arts is. But the strongest reason he gives against the possibility of linens ever being as cheaply made as cotton goods is that *he don't believe it!* We have already shown that the objection that flax costs more than cotton does not exist; that, on the contrary, the raw material for linens can generally be procured for one quarter to one-half the cost of cotton. It is assumed by some that the glutinous matter cannot be removed from the flax fibre without great expense in chemicals, &c., which would make the materials cost much more than cotton. We have already seen that this is incorrect, but, as some persons may require more proof, reference may be had to the testimony of persons who have been engaged in investigating alleged improvements in rotting processes. It was formerly supposed that hemp and flax must either be immersed in water until fermentation takes place, by which the azotized matter enveloping the flax fibres would become decayed, rotted, so that its cohesive force in holding the filaments together, and the harl to the woody portion, would become sufficiently weakened to allow of free separation. Professor John Wilson, F. R. S., &c., &c., in an address already mentioned, states that, by processes of Watts and Buchanan, of Glasgow, patented a few years ago, flax was put in a good preparation for spinning purposes, or rather

for scutching, by repeated immersions of the straw in simple warm water for a few hours only.

Reference has been already made to some new machinery and processes invented in this country, by which it is claimed to be *demonstrated* that linens can be produced as cheap as cotton goods. Some further notice of these demonstrations may be useful here.

Several years ago, in one of the southwestern States, a man took into a printing office a substance resembling white silk floss, which he declared to be hemp. The sample created general surprise and admiration. In answer to the many inquiries which were naturally made as to how this astonishing result was obtained, it was found that a lady, having heard that hemp could be made fine enough for linen, tried to produce the desired result by rubbing, pounding, and heckling, but did not succeed, on account of so many fibres being cemented together by glutinous matter. Brushing and combing were also tried without success. The glutinous matter, as they told her, was all the trouble, and as she could not get this glutinous matter out in any other way, she, like a sensible woman, *washed it out*. A few immersions in a bleaching fluid gave a beautiful whiteness. The difficulty in drying soft the great quantity of short, *towy* fibres brought away in heckling after the refining, and the apparent difficulty in managing in any similar way large quantities in bulk, tended to prevent any further practical development of the thing by the same parties. But a person of a mechanical turn of mind, who heard the account of the preparation of this little specimen, turned his thoughts to the matter. It occurred to him that the difficulties above indicated might be overcome by a proper arrangement of machinery and processes, mechanical and chemical means combined, and the preparation of the fibre of hemp or flax for fine purposes be achieved at a far cheaper rate than was possible by the usual modes. The plan of breaking the straw by machinery in the unrotted condition, the machine delivering the material in the endless or sliver form, and keeping it in this form through all the subsequent machines and processes necessary to render it fine enough for linen purposes, was the one which was ultimately adopted with success. The order was thus:

1. The breaking; the unrotted straw being spread on a feed-cloth leading to the machine, one handful of straw lapping upon the preceding one, making a continuous endless sheet of flax, delivered from the machine in the endless sliver condition, either in large cans or coiled on the floor.

2. The slivers from the breaking machine, parted at convenient lengths, were next passed through coarse gill-pin drawing frames, for the purpose of further dividing the harls, removing any remaining shives, clearing and straightening the filaments, after passing through two or three drawings.

3. The slivers were placed in cans, and warm water applied for several hours, when several cans were placed beside a pair of simple fluted rollers of wood, brass, or any material suitable for wet processes. A boy inserts one end of each sliver between the rollers, which, when set in motion, draw all the slivers out of the water, squeezing them nearly dry in passing through, and deposit them in cans with clean warm water on the other side; this to be repeated frequently, according to the degree of fineness required, allowing the slivers to stand in the water for a longer or shorter time.

4. When further refining is required, run through with alkaline solutions in place of water several times.

5. Boil in alkaline solutions, the slivers being in copper wire-cloth cans.

6. Pass the slivers of flax through a machine for parting the filaments to the required length for linen, six to eight inches, the parting having only a slight drawing effect, leaving the slivers intact.

7. The slivers, pressed nearly dry by powerful squeezing rollers, are passed through a machine where they are dried *in motion*, leaving the fibres soft and

loose, without adhering together, as they would have done if dried without motion.

8. The flax slivers are passed through strong gill-pin drawing frames, by which two of the three main purposes of heckling are accomplished, viz.: straightening the filaments and separating them one from another.

9. The flax slivers are now ready to go through the heckling machine, by which the tow or shorter fibres and trash are removed and thrown below, (forming flax cotton,) while the longer fibres, suitable for linen, are passed on in the sliver form, ready for the drawing frames and other preparations for linen, in the same manner as now practiced in the European flax mills.

The bleaching may be performed at the close of the refining processes, or it may be deferred, to be performed on the yarn or the fabric. If the tow is to be used as flax cotton, the bleaching should come before the heckling; if not, this is unnecessary. It is probable it might be found advantageous in some cases to heckle the flax before refining, by a machine for heckling long flax, delivering the heckled flax in the sliver form, using the coarse tow either for making flax cotton or for making cotton bagging or bale rope. The heckled flax slivers, when refined as above, will work more satisfactorily than the tow or tier, making a less quantity of tow or flax cotton, while it will be of a superior quality, making excellent fillings for linen goods. It will be observed that the process of refining the unrotted flax in this way is very simple, and the machinery of a comparatively inexpensive character. The old expensive, noxious, and absurd process of rotting or steeping the flax is avoided; the unrotted flax straw is the very kind our farmers can conveniently furnish in any quantity desired; the process can be varied indefinitely, according to the degree of fineness needed. Very little skilled labor is necessary; by the use of the sliver form very little handling of flax is required. It has been fully demonstrated that the rotting of hemp or flax is entirely unnecessary, but if it were necessary, no better or cheaper mode could possibly be devised than to allow the flax slivers to remain long enough in the warm water for fermentation to take place; but in place of being in separate cans, as described above, let them be carefully packed in a large vat, and warm the water by a steam pipe to the temperature desired. By having the flax broken out before rotting, the bulk and the consequent labor and expense of handling will be greatly reduced. To check the fermentation at the right point, so as to prevent the injury which so often results to the fibre from over-rotting, all that is required is to raise the temperature to the boiling point, when fermentation ceases, and the noxious effluvia arising from the water-rotting of flax can thus be greatly reduced. This method of stopping fermentation is a well-known, simple principle of chemistry, but its application to the rotting process of flax and hemp was first made many years ago by a gentleman of Lexington, Kentucky, and was the subject of a patent, which it is believed has now expired. It was found in practice in the refining process above described that there was less difficulty in dissolving out the azotized matter which connects the *filaments* than that which cements the *fibres* together in the filaments. The distinction between fibres and filaments, heretofore mentioned, is of too much practical importance to be disregarded.

The process of dissolving out the cementing substance, which envelopes and surrounds the fibres, has been called *cottonizing*, for the reason that flax or hemp by this means is reduced to a *cottony* substance by the separation of the short or ultimate *fibres*, of which the long hair-like *filaments* are composed. If this cottonizing or refining process be carried too far the filaments will not be left long enough for linen purposes, or what may be of sufficient length will be ragged and *towy*, rendering the material unfitted for making even level yarns. By a little practice the operator can easily determine how far the refining operation should be carried for his purposes. And, since no two persons manage the

processes of preparing wool or cotton precisely in the same way, it is very probable there will be in practice a variety of modifications of the flax refining process. The spinning, weaving, bleaching, and finishing of the linen goods made of white refined flax, by the new method, will be about the same as cotton. The extra expense and labor of preparing the flax for spinning is fully compensated by the less price of the raw material. From experiments and demonstrations that have been made it has been found that the cost of flax roving is about thus:

	Cents.
Fibre, (straw at $5 per ton,) per pound	2½
Breaking and cleaning	1
Refining, (washing out gluten, &c.)	1
Preparing, including heckling, drawing, tow carding, roving, &c.	3
Total cost of flax roving ready for the spinning frames, per pound	7½

The cost is estimated only to the roving condition, because from this point onward the cost of both flax and cotton is the same; that is, when the flax is prepared pure and white, as has generally been done by the new process. Now, cotton roving, at the average price of cotton, (10 cents,) costs fully 13 cents per pound, leaving here a margin of 5½ cents per pound in favor of flax, with flax straw at $5 per ton, the price generally paid by those who buy this material at the west, and if pulled flax straw, at $10 per ton, be used, there would still be a margin in favor of linen goods of three cents per pound. But so persistent are some people in the opinion that linen goods cannot be so cheaply made as to come into competition with cotton goods in price, the correctness of these figures will probably be disputed, unless some further data can be furnished. Some to whom the public have been in the habit of looking as authority on all subjects connected with the practical arts and sciences, and who have voluntarily come forward and oracularly and emphatically decided against the practicability of such a desired result, will, no doubt, adhere to their opinions with tenacity. The expense of breaking the unrotted flax, as proved by the American Linen Company's works, at Marcellus, New York, a few years ago, and at several places in the western States, where the unrotted flax straw is broken out for making cotton bagging and for making tow for upholstering purposes, is generally found not to exceed one-third of a cent per pound for the broken flax; when cleaned in drawing frames, about as much more, being less than stated above. Different kinds of machines are used, some of one plan and some of another, depending on the fancy or prejudice of the owner. Some consist of about twelve pairs of fluted rollers, the flutes increasing in fineness towards the delivery of the machine, the rollers being about three feet long, and four to five inches in diameter. These run rapidly, but do not deliver in the sliver form; the flax is frequently run twice through. The flax can easily be cemented into the sliver form, if desired, upon properly constructed drawing frames, as is done with heckled flax line, as described in the account of the present European mode of making of linens. Another plan of a breaking machine, and which was found very effective at Marcellus, and at the bagging manufactory at Eaton, Ohio, is this: six pairs of fluted rollers, about a foot apart, are placed on a frame, with a motion necessary to move a sheet of flax about eighteen feet per minute. The flax straw is fed to the machine, as evenly as possible, on a feed-cloth. Beaters of wood or metal between the first three pairs of rollers are made to move up and down rapidly, acting each way upon the sheet of flax, not unlike the action of the blades of an old-fashioned flax-brake; and between the other pairs of rollers are combs of strong, sharp steel gill-pins, striking rapidly into the partially broken flax from above and below, and moving a short distance

forward through the flax by the action of a crank, like the motion of a doffing-comb on a wool-carding machine. The fluted rollers and the beaters knock out some of the shives and divide some of the harls of flax. The combs divide the harls yet more, and loosen most of the adhering shives, which mostly fall below, the broken flax being condensed or contracted to a narrower space, being brought down from about a yard wide to eight to ten inches wide, and delivered in the endless sliver form. These machines all break about two tons of flax straw daily, tended by a man and two boys, with a man part of the time to deliver straw to the machine. *There is no waste of fibre* or tow falling from the machines. Two tons of unrotted flax straw will turn out from eight hundred to one thousand pounds of broken flax in the crude, unrefined state. This loses about half in refining, so that it requires two pounds of the broken flax, or eight to ten pounds of flax straw, to make one of pure fibre. Estimating the cost of labor at the usual prices paid in this country, it will be readily seen that the cost of breaking does not exceed the above estimate. The breaking machines require from six to ten horse-power each, and when steam power is used in running several of them the shives alone will furnish ample fuel for the engine. The shives are highly combustible, burn with clear white flame, and the same weight of fuel of other kinds will not, apparently, make more steam, especially when fed to the fire by a fan propelled by the machinery. The shives in flax mills working flax in the unrotted condition, or even those that use flax in the straw, rotted or unrotted, are an encumbrance which can be far more cheaply and easily removed by burning than in any other way.

It will be seen that in breaking four tons of flax straw, which would be done by two machines, about three tons of shives would be produced. Hemp produces more shives in proportion than flax. About six tons of hemp straw, in the unrotted condition, are required to make one of broken hemp. At the Maysville establishment above alluded to, where for several years the unrotted hemp was worked in the manufacture of *kyanized* cordage, and in the preparation of unrotted hemp for the New York market, no other fuel than shives was employed in running less than a ton of broken hemp. The engine was estimated at 60 horse-power; cylinder, six feet by fourteen inches; two double-flue boilers, thirty feet by forty inches. This engine, with no other fuel than the shives, was found amply sufficient for running two breaking machines, with drawing and spinning frames for spinning rope yarn, a tow-carding machine, and the rope machinery for forming and laying up the rope. It was often found that when running the two breaking machines it was necessary to open the flue and furnace doors to prevent making and wasting too much steam. The shives, as they were thrown out by the machines, fell into a flaring-shaped box below the floor, in the bottom of which ran a narrow feed-cloth, which conveyed them to a small upright sheet iron pipe, with a hopper-shaped top. A horizontal fan at the bottom, propelled by a small belt at the top, threw a stream of shives, with a current of air, constantly into the fire as they were produced. Sometimes a sufficient amount of shives would be accumulated about the factory, notwithstanding the ordinary means for sending them forward, to run the engine a day for the other machinery, when the breaks were not in use. In this case they were gathered in heaps near the openings into the conveyor-box under the floor, and fed into them gradually by a small boy. There is no patent in this device, and it is believed that a similar arrangement would be found advantageous in supplying saw-dust as fuel to the furnace, in place of the usual mode of throwing it in with a shovel. When thrown in with a fan it is as if sprinkled in with the hand; the combustion is rendered much more perfect, with a clear flame. It is a curious fact that live coals from a wood fire, when placed upon a heap of flax shives, though some of the shives may become charred, the whole will soon become extinguished unless fanned by a tolerably strong current of air. There may be a question with some that in the use of drawing-frames for cleaning

flax, in place of the more simple scutching, as usually practiced in preparing rotted flax for the subsequent preparing machinery for making linen, a needless expense may be incurred. This might be the case if the English spiral gill-frames were used, which, on account of some peculiarities in their construction, are limited to a slow motion. But drawing-frames have been invented in this country, which, while they do their work quite as well as the English spiral gills, do four times more of it, and do not cost more than half as much money; and this is true of more than one kind of American drawing-frames. Then, the scutching of unrotted flax would not do much good; it would neither separate many of the adhering filaments nor loosen many of the shives that might have escaped the operation of the breaking machine. Three drawing-machines, tended by as many boys, will clear a vast amount of flax in a day—from eight hundred to one thousand pounds—being in a convenient sliver form, in cans, ready either for the heckling machine or the refining, wet, or chemical processes. No breaking machines have yet been made that will make the flax sufficiently clean of shives without some other cleansing machinery or processes. It is hardly necessary to be stated that special care must be taken in the construction of flax machines to avoid everything that will have a tendency to rupture the filaments, or too much tow will be produced. Many mistakes of this kind have been made; and sometimes, when a machine that has been used for breaking unrotted hemp or flax has been found to injure the fibre, thoughtless persons have imagined such a result as inevitable, and have pronounced the breaking of these staples, in the unrotted condition, without injury to the fibres, an impossibility.

In reference to the feasibility and cheapness alleged of removing the glutinous matter which envelops the filaments and ultimate fibres of flax, it is highly probable that many who think it impossible that linens can be made as cheap as cotton goods with the raw material at one-quarter the cost of cotton, will call in question the correctness of our statement touching this point. Any one can determine this matter very easily for himself. Let him take a handful of unrotted flax straws, and, after crushing them under the foot, strip the straws, two or three at a time, between the thumb and a bone paper-cutter or folder, so that the straws shall bend over the edge of the folder, for the purpose of removing the shives. Immerse this flax, when thus broken out, in a little warm water, and allow it to remain for several hours. Change the water two or three times, squeezing out the water each time. The water will be found much discolored, showing that it has had a solvent effect upon the flax—that something has been dissolved. Make a warm, weak lye with wood ashes, or by dissolving a little soda or saleratus, and wash the flax in it, or rather immerse frequently, squeezing out the fluid, thus imitating the action of passing it between pairs of squeezing rollers. If, after this, it be boiled two or three hours in this alkaline solution and rinsed out in warm water, the appearance of the flax will be greatly changed for the better. Instead of the coarse, harsh, hair-like, rigid material it seemed at first, it will be found fine, soft, and silky in appearance. In place of the immersions and boiling in the alkaline solutions, washing in warm soapsuds and boiling in the same may be substituted with about the same results. This may be bleached to a beautiful white by immersions in a very weak solution of chloride of lime, alternating two or three times with water rendered slightly sour with a few drops of sulphuric acid, or in sour whey or milk. Rinse out in soft warm water. If the flax filaments are parallel and untangled at the beginning of the process, they will probably be found so at the end, for it is very difficult to tangle wet flax. No matter how coarse the flax was at the beginning, it will be found as fine as could be desired at the close of the process, if well conducted. If coarse hemp be treated in the same manner the result will be the same; both will be rendered equally fine. Berthollet made this discovery more than half a century ago, and it is useless for

inventors in our day to attempt to claim credit for it. The most that can be claimed by the inventors of our time must relate to machinery and fixtures, or devices for economically rendering these previous discoveries available.

Some may wonder how the parting of the filaments to six or eight inches can be effected without disturbing the endless sliver form of the flax, on which depends more than anything else the economy of the refining and preparing processes. By taking a portion of the wet, refined flax from warm water, it will be found, by holding it firmly between the thumbs and fingers of both hands, placed six or eight inches apart, and stretching the flax out with a gently jerking motion, that the fibres are easily *parted, not by breaking the filaments, but by the slipping out from each other* of the short ultimate fibres. If the hands are held just as the parting is felt, it will be observed that the flax remains in position as before, and will not become entirely separated one part from another unless drawn out several inches. Thus it will be readily seen that when slivers of wet flax of the size of two or three of a man's fingers are made to pass through a machine so made as to strain the flax periodically between holding rollers properly constructed, the parting can be effected with certainty and uniformity. When the flax sliver has been drawn taut by the action of the holding rollers, regulated to a proper speed by the motion of a cam or other analogous means, a further strain of one-fourth of an inch will part the filaments without disturbing the sliver form, so important to preserve on account of economy of handling. The patent on one machine invented for this purpose has nearly expired. But two of these machines have been made; one for parting hemp down to three feet in length for making cordage, at J. T. Brooks & Co.'s establishment, and one for parting fine flax as above, used at Marcellus, New York.

These machines answered the purposes for which they were invented, but it was the general opinion of those who used them that they could be improved if occasion offered for building more of them. By taking a few harls of unrotted flax or hemp in the mouth and chewing gently for a short time, the glutinous matter will be found well dissolved out, (saliva being an excellent solvent, next to the gastric juice,) the fibres will be found finely divided, perfectly white, and easily *parted*, while wet, by the thumbs and fingers to any desired length. This little experiment alone has often been the means of removing prejudices and enlightening the ignorant in regard to the nature of flax and hemp fibres, and it has sometimes induced the conviction that it is possible to make fine linen of coarse flax. By examining closely the fibres as they appear in either of the above experiments with flax, or the fibres in the samples of flax-cotton, which have been shown all over the country, it will be observed that, so far as can be distinguished by the eye, the flax fibres are as fine as cotton fibres. It is true these fine fibres are imbedded in a glutinous substance, like the bristles in an old paint-brush, but since it can be so easily removed by being dissolved by sundry different fluids, leaving the fibres in their original parallel position, and not, like cotton, in every possible direction, it would seem that among our numerous inventors, to whom nothing appears impossible, there are some who might devise means for cheaply converting this staple into linen. But some of those individuals who will not believe it possible that our inventors can succeed in making linens as cheap as cotton goods, though the raw material for a yard of shirt linen can be bought in any part of our country for from one to two cents, may require to be told something more about the means by which the great expense of heckling flax is to be avoided. Formerly the wool for making worsted was combed by hand, a process similar to the heckling of cut line—short flax—for linen. Now wool-combing machines are used, and the cost of producing worsted goods is, in consequence, greatly reduced. Even carpet chain is now made of worsted yarn. These machines deliver the combed wool in the endless sliver form. Some wool for combing purposes is not shorter than

the flax cut line used for linen; and as the combing of wool is for the same purposes as the heckling of flax, separating the long from the short fibres, called noyls, it might naturally be supposed that a machine that was suitable for one would answer for the other. The great difference is that flax requires more heckling or combing than wool, with more and finer gill-pins. Then, while wool is fed to the combing machine in bulk, as it were, flax has the advantage of being in the sliver condition, or can easily be in this condition, requiring a machine to be somewhat differently constructed. The flax slivers having been passed through the gill-pin drawing-frames, the filaments not only lie perfectly parallel, but they are completely separated from the trash and short *towy* fibres and from each other, so that very little power is required to draw out these filaments, very unlike what exists in the ordinary heckling of flax by the usual European mode of manufacture. The common wool-combing machine in one instance made a fair sliver from the flax, prepared and parted as above, for linen purposes, and it is not improbable that a better wool-combing machine might answer this purpose admirably, in which case the flax-heckling machine might not be needed. Or, if any doubt should exist in regard to the working of this machine in a large way, our Yankee inventors, who know no such word as "fail," can soon make one that will work, if called for.

It has been found that it is not necessary to form the roving with a twist, as is done on the "*regulating roving frame*," which is constructed very similar to the "fly frame" used in cotton preparation, but that a *false twist*, as used in what is called the "Eclipse speeder," will answer quite as well. The advantages are that the work is done more rapidly, and the machinery is far less expensive. At Marcellus both kinds were used, with no apparent difference in the quality of the yarns produced.

The unrotted flax has been found admirably adapted to cordage purposes. The ropes made of unrotted flax are generally preferred to those made of hemp. These ropes are made in several places in the northern States, in a small way, by hand, which find ready sale in the country retail stores. At Marcellus, ropes were made of the heckled unrotted flax, and while they had a beautiful appearance, they were found stronger than hemp. At Easton, Ohio, both bale rope and cotton bagging are economically made from flax purchased from the neighboring farmers in the unrotted condition. The flax is here grown mainly for the seed, cradled or cut with the mowing machine, and the seed tramped out with horses. Previous to the establishment of the bagging and rope factory there, about four years ago, tens of thousands of tons of this straw were thrown away as worthless, there being no market for it; and the same state of things exists in many parts of the west, where flax-seed is considered a profitable crop.*

The price of this straw is generally $5 per ton. Now, as it requires only from four to five tons of flax straw to make one ton of rope or bagging, (it being worked up in the dry state, without taking out the glutinous matter by refining, as for linen,) *the raw material costs but* 1 *cent to* 1¼ *cent per pound.* This difference in the product arises from the difference in the quantity of lint on the flax straw in different years, generally the earlier the sowing the better the lint; or, if the growth of the flax is checked by an early drouth, and later rains induce a sudden growth, the lint is usually injuriously affected in quantity.†

Another difference arises from the manner of cutting. When the flax is cut

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* C. Beach, of Penn Yan, New York, states in a late circular, that he has a machine for making flax cotton from unrotted flax, and that he has been waiting twelve years for a market!

† In Flanders, where great attention is given to flax culture, late sowing is sometimes resorted to for the purpose of securing *fine fibre*, but the quantity is thus diminished. The fibres are not really finer, as they suppose, but the bark containing the filaments is thus rendered thinner, and the filaments are more easily separated.

too high, the ground being uneven by neglect of rolling, the lint will be light, the most and best of it being left in the stubble. From data established at Eaton, fair bale rope can be produced on a large scale at 2½ cents per pound. and bagging for covering cotton bales for five to six cents per yard, weighing two pounds to the yard. By heckling flax by machinery in the sliver, the best of naval cordage can be made for not exceeding six cents per pound, or less than the average price for the last few years of rough undressed hemp in the bale! Carpets made of the unrotted flax are exceedingly durable, and can be produced at about ten cents per yard, three pounds to the yard. The tests that have been made of carpeting have led to the belief that unrotted flax carpets will last longer than the *coir*, while in every other respect they will be found equally desirable. A cheap, thin article, generally woven as a large check plaid, sold in this country as "hemp carpeting," is not hemp at all, but made of *jute*, the material of which gunny bags are made. It has very little more durability than brown paper. Several millions might be profitably invested in the manufacture of coarse unrotted unrefined flax for cotton bagging, bale rope, cordage, sacks, and carpeting, to say nothing of hemp. Heretofore ropes have been made generally of hemp, not because it is stronger, but cheaper than flax. This is true of the rotted article, but not of the unrotted. The seed pays for the flax crop, but with hemp it is otherwise. If a lint crop of hemp is made, the seed does not mature, and when a crop of hemp-seed is made, the lint is lost. When flax is rotted, the extra amount of handling necessary in converting it into a merchantable shape, over what hemp requires, causes it to bear a higher price, and hence it is not often used for cordage. When hemp is high, rotted flax that is coarse or otherwise unfitted for the linen manufacture, or, as is often the case, when there is no market for the flax, ropes are made of it, and, as mentioned above, they are generally preferred by the country people to hemp ropes. Rigging of vessels was formerly made of flax, and whether it shall be again is a mere question of price.*

Most of the hemp used at the navy yards for the rigging of government vessels is imported from Russia, as a supposed necessity, since our American dew-rotted hemp is not adapted to the purposes of naval cordage, and our hemp growers cannot be induced to water-rot hemp to any great extent, and when they do it is often found to be not only rotted, but rotten; still, there are those who contend that the only way to render flax and hemp both strong and durable is, first, to make it half rotten, which the usual rotting process truly does. In Russia, where the hemp straw is immersed for a time in cold water, frequently under the ice, fermentation does not take place, the hemp being only submitted to the solvent action of water; but in this country, when water rotting is attempted, it is either in warm weather, or the water is warmed by artificial means, so as to induce fermentation, and every chemist knows that fermentation

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* Pliny, speaking of flax, asks, "What greater miracle than that there should be a plant which makes Egypt approach nearer to Italy; that there should grow from so small a seed, and upon so slender and short a stalk, that which, as it were, carries the globe itself to and fro." By this we must infer that its use, both as ropes and sail-cloth, was well known. Again, speaking of snares made from it to entangle wild boars, and so hard as to resist even the stroke of a sword, he says: "I have seen these snares of such fineness as to pass with the ropes at the upper and under sides, through the ring of a man's finger, one man being able to carry as many of them as would encircle the hunting ground. Nor is this the most extraordinary part, for each strand of them consisted of 150 threads;" thus affording proof that in making ropes there is great advantage, if we would secure the greatest strength, of using fine yarns. He also states that in the temple of Minerva, in Rhodes, the breastplate of Amasis, a king of Egypt, was found made of this net, each strand containing 365 threads. This was exhibited at Rome, in his time, as a specimen of both fineness and strength, and also of skill in spinning and twisting yarn. It is supposed that modern times have nothing to compare with it. This is a matter which ought to attract the attention of the government.

is the first step to decay. This, too, must be evident to any one who has ever observed the offensiveness of the odor arising from the water-rotting of hemp or flax, bearing a very strong resemblance to that of rotten eggs. Fevers are often occasioned by it. Another advantage it is plausibly supposed the Russian hemp has over our own is this: The serfs, in breaking it out in their huts in the winter, hang it up where it gets smoked, or it becomes smoked in the drying of the wet straw. The pyroligneous acid unites with the gluten of the hemp, and being a well-known strong antiseptic, has a tendency to preserve it from decay. To a certain extent, the hemp becomes kyanized, as wood is sometimes immersed in a solution of pyroligneous acid to insure durability when used for vessels, bridges, &c. To these two things alone, the manner of rotting, or, rather, *watering*, and the kyanizing effect of smoke, are to be attributed all the superiority possessed by the Russian over the American, unless it be the less length of the Russian, only four to five feet, rendering it more convenient for spinning into rope yarns than our long six to twelve feet hemp. If the same rule holds in Russia as in this country, that an acre of hemp produces as many hundred weights as there are feet in the length of the straw, the product in that country per acre is only about 400 to 500 pounds, while throughout the hemp districts of this country the average product is about 700 pounds, showing, conclusively, the superiority of our country over Russia for this staple.

It has been ascertained that either flax or hemp ropes made of the American unrotted and kyanized material are superior to those made of Russian hemp, both in strength and durability. The term *kyanizing* is now applied to all processes for preserving timber and other vegetable matter from decay by the use of antiseptic solutions. This process is named from Mr. J. Kyan, an Englishman, who, many years ago, endeavored to secure the general adoption of this process for the preservation of ship timber. Corrosive sublimate was the material which Mr. Kyan employed for the purpose, but chemistry has shown that other substances can be used with equal advantage, and much less expense; arsenic, sulphate of iron, sulphate of copper, and some other substances have been used with more or less advantage by the French chemists, who have taken the lead in this art. Chloride of zinc was successfully employed by Burnet, a surgeon in the British navy, several years ago, for kyanizing rope yarns, and this was the substance used at Maysville, Kentucky, for kyanizing cordage made of unrotted hemp. It was prepared by dissolving zinc in muriatic acid, and this diluted with water in a large tub to such an extent as to give but a slight alum-like taste to the chloride when placed upon the tongue. The yarns were immersed in the solution for about twelve hours, drawn out with a heavy reel over the tub to drip for an hour or two, then stretched out to dry. This made the rope almost indestructible from ordinary exposure to the weather. The expense was trifling; the color was but slightly affected, and the rope had the rich yellow color like the Russian cordage, from which it was not easily distinguished. The ropes were used on boats, and daily wet for months without decay; clothes lines hung out a year, and ropes lay out on the ground in damp situations for the same time without showing any signs of decay. Pieces of rope and bagging prepared in the same manner were placed in dung heaps with like samples made from the common rotted hemp; the latter were as rotten as the dung itself after a few weeks' exposure, while the kyanized samples were unaffected. Similar tests can be made in a few weeks by any one who has any doubts upon the subject without the expenditure of one dollar. This kyanized cordage, made of the unrotted hemp, was recommended and used by many in preference to the Manilla rope in all situations where it was liable to get wet, and where no one would think of using rope made from rotted hemp. It was found in numerous tests, public and private, to be twenty per cent. stronger than the Manilla, wore smoother, and was less liable to *fray* in *snubbing*, qualities rendering it superior to Manilla for running rigging. This cordage was found

to have a marked advantage over that from rotted hemp when tarred; it was more flexible, and was not liable to what is called *burning*. A specimen of bolt rope that had lain two years, was found to be as pliable, to all appearances, as when first made.

By working hemp in the unrotted condition it can be produced as advantageously in the northern States as in Missouri or Kentucky. Any land that will produce good corn is also adapted to hemp. Excellent crops are produced in Indiana and Illinois; and, over thirty years ago, as large and fine crops were grown in western New York as were ever grown in Kentucky. The great amount of winter work required in breaking it out, and the unfavorable weather in that climate for the business, induced the abandonment of the attempt to grow hemp there. The late Governor Chambers, territorial governor of Iowa under President Harrison, stated that in 1842 he grew as fine a crop of hemp there as he ever grew in Kentucky. But there is no inducement for northern farmers to go into the culture of hemp unless they are prepared to rot and break it out, or unless factories are established near them, prepared to buy the unrotted hemp in the straw. So long as hemp shall be employed for cordage purposes it is certainly preferable to work it in this way, though it would be found that the cordage manufacturers in the eastern cities would generally suppose their interests lay in another direction. Experience has shown that men are generally opposed to whatever seems to conflict with their established business and apparent interests; and those who manufacture ropes on any other principles than those already in vogue can look for nothing but the most determined opposition from the trade.

It is important to the agricultural interests that flax and hemp factories be established all over the country, for the purpose of creating a market for these staples in the straw. If the effect of our present troubles shall be, as has been hoped or feared, to induce the farmers of Kentucky or Missouri to reduce the number of their slaves, it will certainly be very desirable that such factories be established in those States, and such facts as may have a tendency to enlighten capitalists having a desire to make investments in manufacturing may be useful.

Some of the experience by which these facts were developed has been rather dearly purchased, but they are not the less valuable on this account. The ascertained cost of breaking the unrotted hemp and flax by machinery (it cannot be done profitably by hand) is about one-third of a cent per pound. The cost of hand-breaking rotted hemp is very uniformly one dollar per hundred-weight in the hemp districts, when broken by hand in the usual way. The cost of preparing and spinning the hemp into rope yarn, as ascertained at the Maysville establishment, was within two-thirds of one cent per pound, with the exception of the heckling, which, when the hemp was properly prepared, did not vary materially from that of heckling dew-rotted hemp. The unrotted hemp was usually purchased and delivered at one dollar per hundred-weight less than the price of the dew-rotted in the market, the quantity being *estimated* in the field by the size of the ricks, length of straw, amount of land, &c. This has generally been deemed too high; but the hemp-grower could plausibly argue that, as the breaking would cost him but one dollar per hundred-weight, and the cost of spreading and rotting would certainly amount to no more labor than the hauling to the factory, he ought not to take less. Still, as prices then ruled and as they have generally been since, his profits were enormous, compared with what northern farmers would consider a fair return for their labor. For instance, one crop of sixty acres brought $3,000, or $50 per acre; and when it is considered that it costs no more to grow a crop of hemp than a crop of oats, omitting, as in this case, the cost of breaking, baling, &c., the profits were out of all reasonable proportion with other crops. As hemp is the least exhausting of all crops, frequently being grown on the same land for ten or fifteen years in succession without any appreciable deterioration, and as it can be sown in April

and harvested leisurely in the month of August, when the hurry of the grain harvest is over, there are very few northern farmers but would have readily embraced the opportunity of growing so simple a crop for $1,000, or $16 66 per acre, or one-third of what was paid in the instance above cited. In that case the cost of the hemp was about five dollars per hundred-weight, while in this supposed case it would be a little less than two dollars per hundred-weight, and would make a saving of $2,000 in about thirty days' running of a factory working a ton a day. There is no necessity, then, for a manufacturer to go into the so-called hemp districts to procure the raw material; he has only to go where there is good rich land, capable of producing *good* Indian corn. Farmers anywhere will gladly grow hemp to sell in the straw, unrotted, wherever there is a market for it near enough for them to make one load a day. It will be seen that its culture, as well as flax, is very simple. Like flax, it has no diseases, is not subject to injury from insects, and its only enemies are drought, poor land, and hail-storms.

So inveterate are the habits and prejudices of men in all trades, it is probable that hemp will still be used for cordage purposes for a long time to come. This would indeed be likely to result even if it were proven by proofs "strong as holy writ" that flax were every way cheaper and superior for this purpose. A careful estimate, then, of the probable cost of cordage produced from the unrotted hemp, kyanized, may be some assistance to those in the trade who are not too closely tied to old methods to which they have been long accustomed. It is fair to suppose that crops of hemp can be procured to be grown on suitable lands in the northern or western States for an average of $15 per acre. The raw material sufficient for a ton of rope will cost, then, but $45, *not subject to loss*, while the average price of raw hemp, dew-rotted, in the market for the last few years has been about $120, subject to a loss in working of about twelve per cent., or six cents per pound, and the Russia over $200, or ten cents per pound. Taking this supposed fair basis for the cost of the raw material, the figures, from established data of the Maysville establishment, will stand thus:

	Cents.
Raw material, hemp crop, delivered, at $15 per acre, (three acres to the ton,) per pound, say	$2\frac{1}{2}$
Breaking, preparing on drawing frames, and spinning by machinery	1
Kyanizing and drying	$\frac{1}{8}$
Heckling by hand, at $1 per one hundred pounds tow, equal weight	$\frac{1}{2}$
Total per pound	$4\frac{1}{8}$

If we add the known cost of laying up the yarn into rope, reeling, tarring, dressing, &c., the same in all rope, the whole cost will not reach 5 cents per pound for producing a rope superior to the best Russia and also superior to the Manilla, for which even the Russia is not adapted. This is less than even the *raw material* for the cheapest cordage as now made, and, as compared to the expense of running on Russia cordage, would figure up immensely to the manufacturer's advantage, were he making only a ton a day, even allowing for the inferiority of the tow, which is more shivery than that of other hemp. Many establishments make over five tons of rope daily. The actual saving in working a ton a day, making a half ton of cordage of heckled material, and allowing the tow rope to sell at cost, would be about $70 a day, to say nothing of the entire saving of fuel, when, as usual, steam power is employed. The breaking machines for hemp cost about $500 each, and the drawing and spinning frames somewhat less than those in general use in naval cordage establishments, where spinning by machinery is employed. The spinning frames had four upright spindles each, somewhat on the throstle principle, each spindle turning off about 100 pounds of rope yarn daily, of course varying in quantity according to the

fineness of the yarns. The frames were estimated to cost from $50 to $75 per spindle. The expense of an establishment for working a ton of unrotted hemp a day is not far from $16,000, thus:

2 breaking machines, at $500	$1,000
1 parting machine, $150; 3 drawing frames, $750; 3 spinning frames, $900	1,800
1 reeling machine, $100; 1 bobbin machine, $100; 1 card, $500	700
1 forming and laying jack, $500; 1 laying jack, $200	700
1 laying jack for small work, $100; 1 reel, $50	150
Building and grounds, $6,000; engine, boiler, &c., $4,000	10,000
Shafting, machine-shop, and tools, say	1,650
Total	16,000

Now, suppose there be added for running capital $7,000; we have $24,000 as the requisite capital for starting such a concern. If one cent per pound profit is made on the rope—a profit usually deemed quite satisfactory in cordage establishments—the investment would pay $6,000, or 25 per cent. on the investment; but when we consider the prices of cordage for the last ten years, a much larger profit may be expected, for it matters not what the cost may be of an article to the manufacturer, he puts it in the market expecting prices proportioned to those of other similar articles. Sales of cordage netting 9 cents would make a profit of 4 cents per pound, or a profit of 100 per cent.; but it is not probable that good Russia cordage has sold so low as this for many years. Of course the above estimate is based on the purchase of the raw material at fair remunerating prices compared with other farm products, and not upon such high speculative rates as many hemp and cotton growers have been accustomed to. With pulled flax the results are about the same, with this advantage, that the tow of the flax is better adapted to rope purposes than hemp tow, on account of the smallness of the shives as compared with hemp shives. By using the machine for heckling in the sliver, the cost of the rope would be reduced nearly one cent per pound. By using the cradled cut flax, such as is produced in the western States, where flax is grown mainly for seed, the cost of rope would be reduced about one cent more to the pound. In either case the tow may be converted with advantage into hemp cotton or flax cotton, leaving only the heckled material for cordage. But there will be many persons long accustomed to rope manufacturing who will not believe that as much profit can be made on rope with the raw material at 2½ cents per pound as with Russia hemp at 10 cents per pound, and it may be objected that the attempt to work unrotted hemp has been repeatedly tried and failed. This is granted. It was tried and failed at Bryant's Station, Kentucky, more than twenty years ago, from the following among other causes: The breaking machines were imperfect, doing too little work, and that imperfectly. Like many others, they were better calculated to break their owners than hemp. Beautiful cordage was made of unrotted hemp, but it was found worthless. When wet in warm weather, flies would gather about it, like a dead fish, an offensive odor would arise from it, and presently it would be found full of maggots. Even tar was found ineffectual in its preservation. By the exertions of Mr. Clay, a naval vessel was fitted out with it, and, after a cruise of two years, the cordage was found in a state of decay. An expense of one-eighth to one-fourth of a cent a pound in kyanizing would have prevented this. Even before this, a similar failure occurred in working unrotted hemp cordage in Vermont, and another with flax in New Jersey. In all these cases the failure was mainly attributable to the neglect of kyanizing. It has been supposed that the failure of the Maysville establishment arose from the business of working unrotted hemp being found unprofit-

able, but this is denied. The main buildings, with the machinery, were burned when first completed; and just as the new fire-proof buildings, with new machinery, were completed, and some debts of considerable amount had been incurred, the money partner, a European merchant largely engaged in the shipping and commission business, failed, when the concern was compelled to close by assignment. Some mistakes had been made in the business, such as making too much large rope for river purposes, which, on account of the persistent and not always honorable opposition of those engaged in the Manilla rope trade, it was found difficult to get into use to a sufficient extent. Care and faithfulness in the kyanizing was not always sufficiently secured, and in some cases, when the rope was used for some time wet, the full strength was not retained. A weak solution of the chloride of zinc alone will not always prevent the softening of the gluten in water when long exposed to its action, and the rope parts more easily than it ought, by the slipping out of the short fibres of the hemp. A perfect remedy for this has been found in the use of a tannin solution, as the *ooze* from a tan vat, after being immersed in the chloride of zinc solution.

More attention has been given to the *manufactures* of hemp and flax from the belief that these have but to be greatly extended, in order to create the necessary markets for these staples to induce our farmers to cultivate them to any desired extent. It is evidently useless to urge farmers to grow what they cannot sell, and until a demand is created by the establishment of factories for working up these products in the unrotted condition, the only condition in which our farmers can be induced to produce them, it will be wisdom on their part to wait. For many years attempts have almost constantly been made to induce the American farmers to pull or water-rot flax for the European markets, but without effect. Nor have better results attended the numerous and oft-repeated efforts to get farmers in the hemp districts to water-rot hemp, so as to come into competition with the Russian. If capitalists can be induced to buy these staples in the straw, cut or otherwise secured with little labor, there can be no difficulty in securing as much as may be needed. And if they cannot be had at one price, they can at another. It should not be expected by the manufacturer that the farmer will grow flax or anything else for his use, on which he does not make a profit equal to what he might ordinarily make on other crops; nor should the farmer expect or exact more. It will not do for manufacturers, if they would secure their supplies at the most favorable terms, and with the desired certainty, to either hold out inducements to farmers by the prospect of extravagant profits, or to fix a certain price for future years. One firm at the west, after giving the neighboring farmers every assurance that $5 per ton would be paid for the unrotted cradled flax-straw, (which they generally partially rotted and converted into tow for bale-rope purposes,) lately refused to pay more than $2 per ton for it, on account, as they said, of a reduced demand for their tow; the result was general disgust and a good deal of swearing that no more flax would be grown. The effect upon the farming community would have been better had the firm declined purchasing at all as a business necessity, arising from the extraordinary condition of public affairs, by which the demand for bale-rope for cotton bales was destroyed. Another party, who from necessity or a mistaken policy had broken faith with the farmers, now raises the objection to any movement in this country looking to the extension of the manufactures of flax-rope or linens; that the flax cannot be had; that the farmers cannot be relied upon to grow flax. In the same way a linseed oil manufacturer, who not long since entered into a conspiracy with others in the same trade to pay only a certain low price for flax-seed, until about the next seeding time, by which the farmers suffered great losses and inconveniences, is beginning to doubt whether even flax-seed will be much longer produced in this country, so many extrajudicial oaths having been taken by the farmers that they would never grow another bushel. And it is a curious fact, that may as well here be

mentioned, that during the season alluded to, when flax-seed commanded but 50 to 75 cents at the west, for making linseed oil to be sent to the east, it was in demand in the eastern cities, at $1 40, for making oil to be sent to the west.*

The estimated cost of machinery for manufacturing linen from the unrotted flax, including the breaking, refining, and preparing machinery, is about fifty per cent. more than for the same number of spindles in cotton; but since the raw material for linen costs so much less than cotton, and can generally be purchased as wanted from the neighboring farmers, a much less amount of *running capital* is required than for cotton factories, where it is frequently important to make heavy purchases of raw material for a supply of many months. It is, in fact, a very serious drawback to the business of manufacturing cotton, that it is deemed necessary that the manufacturer be also a cotton speculator, in order that he may be the more sure to make advantageous purchases. Hence he must have large means, it is supposed, to buy when the prices are low, and gain advantages over those who can only buy as required. So narrow is the margin of profits in the cotton manufacture that a difference of a fraction of a cent in

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*The stoppage of the Marcellus establishment in 1853, where it was claimed that demonstrations had been made that linens could be produced from unrotted flax, at about the cost of cotton goods, has been mentioned as evidence that so desirable a result was unattainable. It has been charged that this stoppage was an attempted fraud on the stockholders by some of the persons concerned in its management, and what was first intended as a temporary suspension, for the purpose of securing the stock for some trifling consideration, became permanent by the exposure of the fraud made by one of the officers, and the withdrawal of those who only could conduct practically its operations. The details of this affair would hardly be suitable for these pages, but it may be necessary to state that the secretary of the company, and who made the exposure of the alleged improper proceedings of a portion of the directors, was sustained in his statements by some of the other directors in attempts the next year to reorganize the company. A thorough investigation was made by the committee of arts and sciences of the New York American Institute of these inventions, at the solicitations of parties of the above company; and their report was made in 1854, fully sustaining the claims that had been made for them. What gives additional importance and force to this report is the fact that an old and successful flax spinner, Colonel John Travers, late of Paterson, New Jersey, was, for this special occasion, on that committee. The following points are in the language of the report:

1st. "That they have examined the samples of flax in various states of preparation, exhibited to them by Dr. O. S. Leavitt, and have received from him full explanations of his processes to perform them."

2d. "It appears that ripe flax, after being stripped of the seed, can be cleansed completely, and be prepared for manufacture without being rotted."

3d. "That from the flax in its earlier stages of preparation without rotting, rope, twine, and coarse fabrics may be made with a great saving of manual labor."

4th. "That by further mechanical processes, the gum, gluten, and resin may be chiefly removed and, by the use of machinery in aid of the usual chemical processes, the flax may be deprived entirely of its color, and rendered fit for the manufacture of fine linens; that thread exhibited to them, apparently in consequence of the omission of the process of rotting, and the substitution of mechanical methods for much of what has hitherto been performed chemically, is stronger than common linen thread."

5th. "That the expensive and wasteful process of heckling is entirely superseded by Dr. Leavitt's processes, and the prepared material is delivered from the last of the cleansing processes in rovings ready to be submitted to the usual spinning machine."

6th. "That the flax cleansed, bleached, and formed into rovings, can, we believe, be produced at a cost much less than that of rotted and heckled flax unbleached, while the inventor claims and adduces satisfactory arguments to prove the probability that flax, ready for spinning into white thread will not exceed good cotton (roving) in its cost."

"Admitting that the processes of Dr. Leavitt have no other advantages than those which your committee can state to be absolutely certain, your committee are of opinion that this result must be attended with very important consequences, and will, if carried into operation on an extensive scale, add much to the agricultural and manufacturing wealth of the United States."

The report was signed by Prof. James Renwick, as chairman, John Travers, and Prof. James J. Mapes, committee, and was probably published in the institute's transactions for 1854.

the purchases of the raw material may often change the balance from profit to loss, and *vice versa*. In manufacturing linens from unrotted flax, a greater uniformity of prices may be relied upon. It has been objected that, by the use of flax and hemp straw, which, on account of its bulk, will not bear transportation, it will be necessary that factories be established near the place of the growth of the raw material. This will be all the better for the agricultural interests, as well as for the country at large; then the very fact that the raw material cannot go into the general market, but must be worked near the place of growth, will, of itself, save the manufacturer from annoying and dangerous fluctuations in prices. It is true that mills may be constructed in country places merely for the purpose of breaking out the raw material and reducing its bulk so that it may be transported to the factory or to a general market; but factories preparing their own material on the premises will have advantages over others.

It will be found difficult to bale or ship flax in the sliver form, but it can be done, and practice alone must decide whether it will be equally successful with the other mode. In regard to the culture of hemp and flax but little need be said. If sold in the straw, in the natural condition, they are the most simple of all crops. The earlier they are sown the better. If late sown, the lint will be lighter, and a greater danger will arise from early drought. In some parts of Germany flax is made a winter crop—sown in the fall. The seed of both must be recent, and, indeed, this is a general rule with all oleaginous seeds. If more than a year old, they are not reliable. Good land is needed for both, but hemp is more exacting in this respect. They are alike, however, in this—recent manuring must be avoided; this makes the stalks unequal. While good land is indispensable for hemp, rich bottom lands are unsuited to it, for the reason that some plants get the start of the rest and choke them out, making much of the hemp coarse and *flaggy*. But, as a general rule, any land that will produce good Indian corn, as has been before stated, will produce good hemp. If the land be poor, the hemp will often not be worth harvesting. Flax, on the other hand, often does well on soils light and thin, and where corn or almost any other crop would be poor. It flourishes well on the light soils of Oswego, New York, and on the barrens (oak openings) of Kentucky. Soils containing much potash are believed to be especially favorable to flax. The lint is not injured by allowing the seed to ripen, as was formerly supposed. It is admitted that hemp is the least injurious of all crops to the land, and may, as before stated, be repeated many years on the same land without apparent diminution of the crop; but flax imperiously demands a rotation of crops. Once in seven years is the least that can be recommended, but a rotation of this extent is advisable for all crops to prevent a deterioration of the soil. On this account flax has been called exhausting, but it has been fully proved that when used in a judicious rotation with other crops it is far less exhausting than oats; and the most scientific and experienced of English and Irish farmers claim that, when used in a rotation of seven years, it is better for the soil than any other rotation without it. Use land clear of weeds as a sod, and follow with wheat, for which it is an excellent preparation. Nature requires a rotation. An oak forest will be followed by pines, and *vice versa*. Plants frequently deposit excrementitious matter, rendering the land unfit for the same plants the next year. When flax is spread upon a field to be rotted, flax will not grow upon that field the next year; not because that land has been exhausted, as must be very evident, but on account of deposits incompatible with the growth of that crop. These deposits, while they act as manure for other crops, are poison to flax. The theory, then, of exhaustion fails. The chemical analysis of the plant, as made by Professor Kane and others, shows that it can be but slightly exhausting, since

nearly all the constituents of it come from the atmosphere. A great advantage would result to the agricultural interests if the culture of flax should force our slovenly farmers into a rotation of crops. *If seed alone is the object*, half a bushel of seed will answer, but a bushel is better; not that a bushel will produce double the seed that a half bushel will, but the amount of seed produced on an acre will more than compensate the farmer for the additional quantity of seed. It is for the interest of oil-mill men, who loan seed to the farmers, that the least quantity be sown. The farmer should consider whether his interest does not direct him differently. In this country, whenever and wherever a demand for the straw shall exist, it will be advantageous to sow more seed, since both the quantity and quality of the straw will be increased. In Ireland they sow from two to three bushels of seed to the acre, and get, on the average, two tons of straw and twenty bushels of seed. In some parts of the State of New York they sow from one bushel to five pecks of seed, and get an average of ten bushels of seed and one ton of pulled flax straw. In Ohio and Indiana, with half a bushel of seed, they obtain an average of seven to eight bushels of seed and less than half a ton of cradled flax straw of poor quality—too many branches, and too much of the stem, with the best lint left in the stubble. It would be better for farmers to use their own seed, and not borrow of the oil-mills. Not many of our farmers can easily be induced to pull flax by hand; the work comes in the most hurrying season, and one person can pull only about a quarter of an acre in a day.

Whenever there shall be a market for pulled flax to any considerable extent, pulling machines will be used. One on which the patent has expired, with one horse, will pull and spread six acres in a day; cost of the machine, about sixty dollars. But if the ground is rolled, as it should be, when the flax is put in, so that it can be cut close to the ground, either with a scythe or mowing machine, it is quite as well for the manufacturer; he saves the weight of the roots, and it answers for all purposes, except for fine linen, when pulling is better, making fewer *stumpy ends*. In time, no doubt, manufacturers will find it to their interest to furnish pulling machines. Flax, as well as hemp, may be safely preserved in ricks or stacks, and both improve in quality by long keeping. The seed of flax is secured by crushing the bolls, either with tramping it out with horses or by passing the seed ends of flax bundles between rollers. The European mode is by *rippling*, or pulling the seed ends of flax bundles through a steel comb, stripping off the bolls. The best mode of threshing the mowed or cradled flax is to pass it between two wooden rollers, with a shaking attachment to shake out the seed, and a straw carrier, like those in grain separators, to carry off the threshed straw. By this mode the straw is less tangled than when tramped by horses. The seed should be clean, and, more especially, clear of the *yellow seed* sometimes called *linseed*. This weed causes special annoyance to the manufacturer. It is perfectly useless to ask the American farmer to weed his fields, as is universally done in Europe, and as the books all direct. Our farmers would as soon weed their wheat as their flax. With clean seed, land clear of weeds, and thick sowing, there will be little trouble with weeds; they are *choked down*.

Hemp sown in April, on good land, carefully prepared, one to one and a half bushel to the acre, gives no trouble till harvest, in August. It is cut with a *hemp-hook*, or, if not more than five feet high, with a cradle made expressly for the purpose. It was once pulled like flax, and so the books still direct; but it has never been pulled in this country to any extent. Like the date, mulberry, honey locust, and the buckeye, the male and female flowers grow on separate and distinct plants. The male is called the blossom-hemp, and the female the seed-hemp. When the blossom-hemp has shed its pollen, it dies. It is easily distinguished from the female by its being smaller, and by constituting about only one-third of the crop. When the male hemp begins to turn yellow is the

time for harvest. If allowed to stand too long, the lint on the male plant will turn dark and become decayed. The cutting of hemp with a hook is performed somewhat like the cutting of corn, the left arm enclosing the stalks backward as they are cut with a striking action by the hook. The hemp is spread out evenly to dry, behind the operator, care being taken that the sharp edge of the hook does not come in contact with the straw in spreading, by which the lint would be injured. The hemp-hooks or cradles can be procured of any hardware merchant in the hemp districts of Kentucky or Missouri. When dry, bind in convenient-sized bundles, and rick or stack securely until hauled to the factory, if sold in the unrotted state, or, if to be rotted, spread evenly for that purpose late in October. When sufficiently rotted, or when the lint will separate easily from the interior woody portion, which will be about Christmas, put in shocks and break out at leisure during the winter, only in dry weather. It breaks best in cold weather, and cannot be advantageously broken out in damp weather, or when there is a damp atmosphere. The hand-brake is of the well-known form of the flax hand-brake. Machinery has never yet been successfully used in breaking out rotted hemp. The reason is this: hemp should be broken only just enough to get rid of the shives; some requires more breaking and some less, depending on the extent to which the rotting process has been carried, the weather, &c. At first a few blows with the brake are given to crack the woody portion, when the operator whips the hemp across the brake to knock out as much wood as possible, so as to subject the hemp to the action of the blades no more than is absolutely necessary to loosen the shives; for too much breaking renders the fibre towy, and the shives become entangled so that they cannot be easily removed. Machinery cannot have this required discretion to regulate the amount and character of the work according to the condition of the hemp. A day's work at breaking hemp is about one hundred pounds, but sometimes two hundred pounds are broken out when both the hemp and the weather are in excellent condition. Almost every northern farmer could grow and manage a small crop of hemp with advantage. Three acres would generally bring him $100, without requiring more labor than other crops, except about twenty days in winter for breaking out.

When hemp is cut in August for the lint the seed does not mature, and when the seed is grown the lint is lost. Some farmers supply themselves with seed by leaving some of the largest and finest seed stalks till October for seed, and others plant a patch and cultivate it like corn for this purpose. It is said that the seed can be grown in the hemp districts for twenty-five cents per bushel, though the price generally ranges from fifty cents to two dollars. Great care must be taken in threshing, as it *shatters* out very easily. In growing flax, both the seed and lint are saved; the seed alone pays generally a good profit to the farmer, and what he gets for the lint or straw is clear gain. In growing hemp, the whole expense of culture must be borne by the lint alone, and on this account the fibres of flax cost to the producer less than that of hemp. The census of 1860 will show that there was produced in the States north of the cotton States 4,547,071 pounds of flax, which, if put in bales of 400 pounds each, like cotton, would make but 11,367 bales. It would require, at only 200 pounds per acre, about 23,000 acres. But the 484,797 bushels of flax-seed grown in that year in the same States, at eight bushels to the acre, would require a little over 60,000 acres; showing that nearly two-thirds of the lint was not saved. At this ratio, in the State of Indiana, only the lint was saved on 411 acres, while that of 19,373 acres was thrown away; but this would be about enough to supply two large linen factories, of 20,000 spindles each, the half of which might be produced on the land within ten miles of a factory (convenient hauling distance) by having one acre in about nineteen in flax. These figures furnish the answer to objections that many thoughtlessly raise, that a sufficient quantity of

flax cannot be produced near the manufacturing establishments to supply them when flax is to be worked from the straw in the unrotted state.

Some suppose that, in case a much larger amount of flax were grown, seed would greatly decline in price. This can never occur, from the fact that flax-seed is worth more for feeding purposes than it generally brings for making oil. Nearly all the flax-seed produced in Ireland and England is fed out on the farm, and very little is sold to oil-mills, though it is generally worth there more than two dollars per bushel. To the general practice of feeding flax-seed and oil-cake is often imputed the peculiar rich quality of the English beef; and it is questionable whether our farmers do not make a sad mistake in allowing so much of our oil-cake to be exported. We have in the United States ninety-four millions of capital employed in the manufacture of about one-fifth of an average cotton crop, or about eight hundred thousand bales. Suppose this were all manufactured into fabrics of three yards to the pound, the product would be nine hundred and sixty millions of yards, and, at one cent profit per yard, would pay a dividend on this capital of a little over ten per cent. The cost of the material for each yard is, on the average, about three cents, and of factory labor, use of machinery, &c., about as much more. The cost of material for linen shirtings of the same weight would be less than two cents, all the rest being labor. Now such linens, at wholesale, command from twenty-five to fifty cents per yard; and if they can be made as cheap as cotton goods, they can be sold at one-half the price of the poorest linens now in our markets, and pay fifty per cent., or sold at fifteen cents, and pay one hundred per cent. To the manufacturing industry of England, mainly in fabrics, is attributed her great wealth and power. If the manufacturing by England of two-thirds of our cotton crop does so much for her, would it not also do much for us? Our great mistake has been that we have not manufactured more of the cotton before exporting it; and experience proves that we can compete successfully with the English manufacturer with our cotton goods in any of the markets of the world. Since this will be readily admitted, the objection that we, with our cheap lands and low taxes and cheap food, cannot compete with England's cheaper labor, is disposed of. If we first manufactured our cotton before exportation, our exports of it would be more than doubled. We would do better still by manufacturing a better, more useful and salable goods from flax, especially if this can be done cheaply.*

By those who hold that the government has nothing to do with looking after the interests of the people, but only its own interests, it may be claimed that the government can do nothing in this matter. Yet the government is manufacturing its own cordage for the rigging of its navy. Looking to its own interests only, it should at once cause an investigation to be made, with the view of ascertaining whether the cordage, which is now made mostly from the Russia hemp, at an expense of over twelve cents per pound, cannot be better made from a home-grown material, either flax or hemp, for about half the money. Then why may not the government make of American flax its own tent-cloth and sail-canvas? If the government cannot do this, a well-constituted, intelligent, and impartial commissioner, appointed expressly for the purpose, ought to show the reason why. The example of the government in testing the capabilities of American flax and American inventions might be very salutary. It might be the commencement of a new era of American independence. It is

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* There is no doubt that figures will sometimes lie; but it is believed that it is easier to prove from established data that one hundred per cent. can be made from the manufacture of either linens, cordage, cotton-bagging, or carpeting, from unrotted flax, than it is to prove that cotton can be manufactured without a loss, say for a period of ten years.

probable that our inventors would allow the free use of their inventions for this object, looking to their reward afterwards from their use by private parties. American inventors have greatly improved upon the old modes of manufacturing cotton and wool, and it would not be surprising if they were to do something of importance in the manufacture of other fibres.

There may be those who will urge that, on account of the almost certain prospect of a decline in the price of cotton, and that it must, soon after the close of the war, come to a price in the neighborhood of the cost of production, like other agricultural productions, six to seven cents per pound, without considering that this would reduce the cost of cotton sheetings only about one cent per yard. Others may think there is not sufficient capital in the country, forgetting how readily, from our abundance, hundreds of millions have been furnished to the government, the many millions constantly on deposit in the eastern cities waiting opportunities for investment, or the five hundred millions invested in bank stocks, most of which is easily convertible at pleasure for other purposes. Others may imagine that labor sufficient for a large increase of manufactures cannot be had, while millions of our people out of employment are scattered through our cities and villages from one end of the country to the other, and ready to be employed for any wages that will keep them decently alive. It seems to be supposed by some that manufactures naturally flourish better in a country where, like England, the raw material must nearly all be brought from foreign countries. They would have to go but little further to assert, quite as consistently, that, before we can by manufacturing contend with England for the control of the commerce of the world, we must, from some cause, be compelled to send abroad for a great share of the food necessary for our wretched population, (compelled to exist on the most scanty subsistence,) as well as for the raw material. But Heaven protect us from such prosperity !*

If this article has not the tendency to attract our enterprising capitalists to the manufacture of flax and hemp, but little good will result from it. A few words, in closing, in regard to those characteristics which must distinguish the manufacturing establishments in this country from those in Europe if they would be successful, may not be useless. Those who contemplate engaging in manufactures in this country should not forget that, if our laboring population are not slaves, they are neither serfs nor peasants, but freemen. They, therefore, expect considerate and humane, if not respectful, treatment from their employers and their agents: while there appears no good reason why a mechanic or working man may not be both a gentleman and a man of education; and it not unfrequently occurs that the operative is quite as worthy and intelligent as the employer. Many working men rise to the highest positions. Not long ago a mechanic was found to be an excellent Speaker of the House of Representatives, and at this moment other mechanics hold high positions in the government. The most successful manufacturing establishments in this country have found it to their pecuniary advantage to make due provision for the moral and intellectual improvement of their operatives by establishing libraries, reading-rooms, lyceums, scientific lectures, &c., to say nothing of making suitable provisions for amusements. By these only has Lowell been able to draw from the intelligent work people of New England a far better class of operatives than could have been obtained by the mere promise of any rate of wages whatever. And to this greater intelligence and worth of their operatives has been, mainly,

* While some attempts to manufacture flax in this country by the common European modes have been unsuccessful, it is far from being true of all. The success of Colonel John Travers, at Paterson, New Jersey, and of a firm at Andover, Massachusetts, is well known. Other cases of success in this country exist.

attributed the great success of these establishments. Whether this view be correct or not, it is believed that no failure of large establishments for the manufacture of fabrics in this country has been where the proprietors had made suitable provision for the *protection* and improvement of the characters of their operatives. There has thus been found both economy and safety in this enlightened benevolence. Great advantages have also resulted in many cases from providing the families of operatives at reasonable rents with comfortable dwellings, with ample room for gardens, and in some instances excellent effects have resulted from allowing the principal operatives to become stockholders; in this way the too often ruinous antagonism between the employers and employés is avoided. In steamboat companies this has been so salutary that most western capitalists are willing to take an interest in steamboats only where the principal officers, at least, are also stockholders. Some of the most successful manufacturers of fabrics are lately adopting the same rule. Failures are not unfrequenty attributed to the insolence and overbearing conduct of clerks and overseers, having no other interest in the success of their business but their salaries. While this may have also occurred in other countries, in ours such results are the more certain, from the fact that our people are not often so very poor and degraded as to feel themselves compelled to submit to uncivil treatment, while there are many, perhaps too many, who had rather die than submit quietly and tamely to what they deem an insult. Those who have been accustomed to the management of work people in other countries often make the greatest mistakes here from ignorance of this peculiarity of our people. For several years the factory girls of Lowell edited and published a very respectable periodical; and many of these persons had been induced to leave the business of teaching, for $1 50 per week, not so much for the increased wages as for the superior educational advantages there furnished. It was found that they were not the less efficient and useful as factory girls by their being able to edit a paper or teach a school. Many a western farm has been purchased from the earnings of factory girls, and many have graced society by their virtues and accomplishments. Whether the Lowell proprietors, as has been charged, adroitly managed to make the girls pay for the educational advantages that were supplied for them or not, it is certain that these were the means of securing for them a far better class of work people than they could otherwise have obtained. The number of landless persons among us is largely increasing, and they are dependent upon their labors only for support. They are generally desirous for situations where they can be enabled to educate and rear their children properly, as their first and greatest object; but when they have received employment they do not consider the obligations to be altogether on one side. With fair wages and good treatment they can generally be relied upon to continue permanently and faithfully at their employment. Many of the European manufacturing establishments were originated by benevolent persons more for the purpose of furnishing employment to the poor than for mere gain; and those enterprises were, in many instances, found to be highly remunerative. Though our people have not in such considerable numbers become so poor as to imperatively require such exertions to preserve them from actual pauperism, it is not to be denied that in very many localities there is distress, and very great need of the establishment of factories for the purpose of furnishing employment to the people; and the good and generous Dales and Oberlins among us may find ample room for safely exercising their kind of philanthropy; nor would complaints against them be made if, while they were to give ample employment, furnishing means for the general well-being and happiness of their work people, they were to make their benevolence financially profitable.

RAISING SHEEP AND WOOL-GROWING.

BY W. S. CALOHAN, OF WASHINGTON COUNTY, PENNSYLVANIA.

THE sheep is an inhabitant of every quarter of the world, from Iceland to the regions of the torrid zone. According to Linnæus, they are thus classed: The Hornless, Horned, Black-faced, Spanish, Many-horned, African, Guinea, Broad-tailed, Fat-rumped, Buckarian, Long-tailed, Cap-bearded, and Bovant; to which add the Siberian sheep, cultivated in Asia, Barbary, and Corsica, and the Cretian sheep, which inhabits the Grecian islands, Hungary, and Austria. But the principal countries in which special attention has been paid to sheep are Spain, parts of Germany, France, Great Britain, and the United States. The present article will be mainly confined to such breeds as are raised in our own country, and more particularly to the States of Pennsylvania, Virginia, Ohio, Kentucky, Tennessee, Arkansas, and Texas.

Leicester.—This breed takes the lead among the long-woolled sheep, and of these there are nearly three distinct varieties: first, the Forest sheep; second, the Old Leicester; and third, the New Leicester, or the Dishley breed, which are an improved kind of the last mentioned. They are handsome in form, and fatten easily, and, when fat, seldom weigh less than two hundred pounds, gross or live weight, which is equal to one hundred pounds neat. They frequently surpass these weights when properly and judiciously crossed and liberally fed. The bones of this sheep are light, and particularly fine for its size; it fattens easily; possesses a quiet disposition, and requires a smaller proportion of food than other breeds of the same size; the flesh is fine-grained and well-flavored, yet often too fat to please most palates. The wool is long and fine, and averages about eight pounds to the fleece, yet it properly belongs to the coarser grades of wool. Some flock-masters and shepherds regard this breed as more hardy and better provided by nature to encounter the inclement seasons of this climate than some other breeds of which I shall speak hereafter. My own opinion, (predicated upon some experience,) is, that they are hardier and shear more wool than some of the finer breeds, yet it usually sells for one-half the price of fine wool, whilst the amount of food required is one-third more than that required for fine sheep. As to the manner of keeping, I would here state that we graze them in Pennsylvania from April until December, after which time we feed oats in the sheaf, fodder, or hay. All good flock-masters provide against storms, more particularly from cold rains and sleets, which usually fall between November and March. The damage done by these storms is incalculable; chilling the animal, producing colds, checking the growth of the wool, and frequently causing death. We usually feed some grain from February to April, say corn or oats. Many flock-masters feed the grains whole, but my own experience enables me to pronounce it injudicious, unprofitable, and unattended with any perceptible benefit to the animals. I have fed fifty head of wethers on whole corn, and the same number on ground grain, and found that twenty bushels of ground grain would equal twenty-five bushels of the whole corn. Here is a gain of one-fifth in favor of the ground grain. But I will reserve for another part of this article a fuller account of the manner of feeding.

South-down.—This breed of sheep are fine-boned, the flesh fine-grained and of excellent flavor; they are quick feeders, possessing a constitution hardy and vigorous; weighing usually eighteen pounds to the quarter, and, as mutton, commands at all times the highest price; they are light shearers, producing wool

from two to three inches in staple, and fine for such a breed. I do not regard them as profitable sheep for this country, nor are there many kept in this section; yet they are more easily raised than the Leicester; the mode and manner of keeping them the same. The product of one of these sheep is from two and a half to three pounds of wool per annum.

I will now mention the fine-wool sheep, about which more solicitude is felt in this section of country, that is to say, German Saxony, Spanish Merino, French Merino, and the Silesian. Of the latter we have but few in this country. I have examined only one lot of this breed. They are a smooth, well-formed and handsome sheep, and about the weight of the Saxon breed, the rams weighing from one hundred to one hundred and twenty-five pounds gross, or from fifty to sixty pounds neat. The wool is very fine and well set on the animal, containing as many fibrous strands to the square inch as the Saxon or any other of the fine breeds, and at one time, when fine wool with a short staple was so much sought after in this country, this breed would have sold advantageously; but at this time a long staple is in greater demand, something which weighs more without regard to fineness, consequently the importer of this flock, failing to find a market here, shipped them in the autumn of 1859 to Texas. With what success he met in that region I know not, yet fear they will not do well in that climate. My own experience, whilst growing wool in Texas, would not warrant me in recommending this breed of sheep to flock-masters.

French Merino.—This breed was introduced into this country in 1848, and the opinion was entertained by some that it would make a fine cross with our Saxon and Merino flocks. They are heavy-boned, rough built, and in no way handsome, but are large and have vigorous constitutions, the rams weighing at four years old from one hundred and fifty to one hundred and seventy pounds gross or live weight. The wool is not fine, but of rather a harsh character, the elasticity and felting qualities of it being very poor. This breed attracted considerable attention when first introduced into our section of country, but a fair trial of it has justified its condemnation. It has greatly injured the wool of every flock into which it has been introduced, and I know of no growers of fine wool among those who purchased and crossed with them who are not anxious to dispose of them as early as possible. They are not only hard to keep, but require more feed, by about one-fourth, than the Saxon or Spanish Merino. The rams cut about eight pounds of wool when washed on the sheep, and the ewes about four pounds, and weigh from eighty to one hundred pounds gross.

The Saxony Merino.—This valuable breed of sheep was introduced into this section of country by Mr. Dickinson, of Steubenville, Ohio, and many of them disposed of to wool-growers in the eastern counties of Ohio, northwestern Virginia, and Washington county, Pennsylvania, and from the time of their introduction to 1850 were more sought after by the growers of fine wool than any other breed of sheep known among us. They are a fine-boned, well-formed sheep, the ewes weighing about eighty-five pounds gross, and the rams from one hundred to one hundred and twenty pounds gross or live weight. They were, perhaps, the only fine sheep in this region of country until 1847, at which period Washington county produced one million of pounds of fine wool. By way of digression, I would state that during that year my purchases of wool in the eastern counties of Ohio, Brooke, Hancock, and Ohio counties, in Virginia, and in Washington county, Pennsylvania, amounted to one million and seventy thousand pounds of wool, the larger portion of which was of the Saxon breed. The average weight for fleece was two and seventy-six hundredths pounds. The wool at that period was of the most desirable character, fine in fibre and fair length of staple, and nearly free from yolk or oil. In fact, the wool of that season was superior in quality and better than I have ever seen it in this country. The Saxon wools are conceded by all flock-masters and manufacturers to be the finest in this country, and affording more manufacturing qualities. This breed

(the Saxon Merino) I would recommend, above all others, to persons who may desire to commence the growing of fine wool. Of the manner of raising and keeping these sheep I will speak hereafter.

Spanish Merino.—For the introduction of this breed we are indebted to Mr. Wells, of Steubenville, Ohio, who was not so fortunate in his selection as Mr. Dickinson. The breeds were introduced in the same year, but the Spanish Merino was not so soon adopted as the Saxon. They are of a more hardy nature, more vigorous in constitution, and shear heavily, partly owing to the quantity, and partly to the amount of yolk, or oil, in the fleece. The quantity of yolk pertaining to this breed imparts to the points of the wool a dark and dingy appearance, and makes the shrinkage in cleansing much more than that of the Saxon—so much greater, indeed, that it loses fifty per cent. in cleansing. I am clearly of opinion that it is a decided advantage to the stock of this climate, serving as a protector against cold rains and sleets, which saturate the wool, retard its growth, and chill the animal. About 1847 our growers began to ponder on some plan of improving the constitutions of their sheep, enhancing the weight of the sheep as well as the fleece, and also adding to their flocks. The truth is, the desire for fine wool was so great that many of them purchased more sheep than they could properly attend to. Consequently the animals became weak, the yield of wool materially diminished, and the constitution of the sheep greatly impaired. At or about this period many growers purchased Spanish Merino rams, and commenced to cross with the Saxon ewes, which has effected a most desirable improvement, not, indeed, in the quality of the wool, but in the constitution of the sheep, and adding greatly to the weight of the fleece.

The reader will remember that in the year 1847 the average weight of the fleece was two and seventy-six hundredths pounds. I handled in this year about seventy-five thousand pounds, the product of this cross, and found the average weight to be about four pounds. Thus it will be perceived that the increase in the weight of fleece was one and a quarter pound per fleece. A part of this increase is ascribable to the fact of keeping smaller flocks, yet mainly attributable to the judicious crossing, constant attention, and liberal feeding of the growers. The wool is not worth so much by one-seventh as the pure Saxon; still the flock-master and shepherd gain, the loss of the stock is less, constitution improved, and the sheep require less attention. I know of some flocks, when these breeds have been crossed, (where the growers do not overstock,) which shear as high as five pounds to the fleece. One flock in my own county, (Washington,) owned by William Berry, jr., numbering only one hundred and forty-seven, sheared this year eight hundred and ninety-one pounds of wool, (washed on the sheep's back,) and in every respect was in excellent condition, averaging a fraction over six pounds per fleece. It is not expected that many growers will derive so large an amount of wool from so small a flock, as Mr. Berry is one of the best flock-masters in the United States. I have examined many flocks of this cross in Pennsylvania, Virginia, Kentucky, Tennessee, Arkansas, and Texas, and unhesitatingly say that this cross is better adapted to the climates of those States than any other of which I have any knowledge. The flock of Mark Cockerell, of Tennessee, is a fine specimen of the cross to which I have adverted. This flock consists of about one thousand two hundred head, sheared as many pounds to the fleece and of as good quality as our flocks in this section of the country, notwithstanding the greater mildness of the climate there. I examined a flock of the same cross belonging to Benjamin Tatum, of Arkansas, and found the wool in every particular equal in elasticity, length of staple, and containing as many strands or fibres to the square inch as any of our fine sheep in Pennsylvania.

During a business visit to Texas (western) I examined a number of flocks of the same cross, and met with similar results.

Management of sheep.—The direction necessary to be observed in the raising

of these animals and in growing wool will now claim the reader's attention. In the first place, the flock-master, or shepherd, must be careful to procure pure-blooded ewes for the foundation of his stock, nor should they exceed the age of three years, as that is the proper age for breeding. The ewes should be in good condition on the first of November, which is the proper season for copulation, at which time the rams can be allowed to associate with them. Their lambs will be dropped about the first of April, the period for bearing them being about five months. And in the selection of rams the greatest care should be taken to get the best, having special regard to the form, size, age, weight, wool of fineness of fibre, good length of staple, and compactness of fleece. The age of the rams should be between the ages of three and six years, and should never be related to the ewes from which you wish to breed, as I conceive "breeding in and in," as it is termed, highly prejudicial, though many of our wool-growers have fallen into it. Such connexion not only impairs the constitution of the stock, but reduces the quantity of the wool, and greatly injures its manufacturing qualities. In the management of rams from which a healthy and successful issue is to be expected, care should be taken to feed them one pint of corn daily, or its equivalent, which is sufficient to keep them in good condition, and never to permit them to have more than fifty ewes in one season, more particularly when they are not kept up, but allowed to pasture with the ewes. When the period shall arrive for dropping the lambs, if there be no grass, they should have some soft feed a few days prior to the dropping, such as oatmeal and water, or bran and water, the former being preferable. At this important period the shepherd should give them his close attention; and when any of the ewes neglect or refuse to own their lambs, he should tie them until the lambs shall have drawn nourishment from them for a few times, after which they seldom fail to recognize their offspring, unless, indeed, they have no milk. The time for weaning the lambs in this climate is about the first of August, and when this is done, it is indispensable to put the lambs on good fresh pastures, so that they may not lose their flesh; and so soon as they will eat it give them bran, or some ground grain, adding to it every other day a small quantity of salt. This salt is intended to neutralize the acidity originating from this kind of feed, and prevents the scours, a very enervating and frequently fatal disease among young lambs. The ewes, when relieved of their lambs, should be put in short dry pastures, in order that the milk may soon dry up, and care should be taken to remove them so far from the lambs that the bleatings of each other cannot be heard. This remote separation alleviates anxiety, the ewes soon become reinvigorated and properly conditioned for a second impregnation in November, the time before indicated.

In regard to the operations of castration and docking, I have found it more convenient, indeed advisable, to dock the lambs when one day old, and resort to the castration of the ram lambs at three or six days old. Before closing this article I deem it advisable to call the attention of the reader to one other fact connected with the raising of ram lambs. Let the best of the ewes be selected from the flock, and on the 1st of October turned into a pasture with the rams for copulation. This will expedite the dropping, making it one month earlier. It is of the utmost importance, however, in pursuing this plan, to shield and protect the ewes from the inclemency of the weather, and feed them with soft food, as before directed. Your lambs will come one month earlier, and consequently be more valuable than late ones. Of the management of flocks in the summer it is unnecessary to say more. The grower should never attempt to keep more sheep than can be amply provided for and judiciously managed. Large flocks are not easily cared for, and, when neglected, prove unprofitable to the flock-master. Small flocks are comparatively more productive and yield a better quality of wool; of this fact the product of Mr. Berry's flock, before described, is an exemplification. Pastures should be changed as frequently as

practicable. Great advantage is derived from feeding grain; in the case of breeding ewes it is essential. Keep the flocks enclosed around the sheep-folds, when the grass is too short to contribute to their sustenance, as they feed better when enclosed. When thus enclosed they can be kept in good condition upon two pounds of hay and one gill of grain per head for one day.

The washing of sheep.—Upon this subject there is a variety of opinion, some approving of the detergent process, while others repudiate it on account of its enervating effects. My experience satisfies me that it is not only beneficial to the stock, when carefully done, but highly important to the manufacturer. The washing should never be done unless the water is warm enough to prevent the chilling of the sheep; always in a clear warm day, and invariably in the afternoon. To facilitate the process, have the sheep driven into a pen contiguous to the pond or stream in which they are to be washed. Pass them into the water and keep them in it sufficiently long to saturate the wool; turn them aside and let them stand for one hour, then bring them into the water again. In this way you will wash them with less labor and have your wool in better condition. The time for shearing should be from five to eight days after washing.

The treatment of sheep in winter has been a source of great solicitude among the wool-growers of our section of country. In the northern States there is nothing appertaining to sheep economy more generally neglected than the provision of warm and ample accommodations for shelter, and from no other cause do such large losses annually accrue. Shelter is the first thing to be attended to in the management of sheep. While every good flock-master or shepherd is decidedly hostile to their being confined or to their being forced into shelter, it cannot be too strongly recommended to all sheep farmers to put the means of avoiding the severity of stormy weather within the reach of their flocks at all times. Some of the opponents of shelters assert, without, however, ever having made experiments to decide positively, that they tend to make sheep tender, induce disease, &c., which is about as reasonable as it would be to contend that man physically degenerates by having a comfortable dwelling to shield him from the cold inseparable from snows and sleets. Those flocks for which there is no protection provided are liable to colds, scab, pelt-rot, and dysentery, and many of their number die from sheer poverty of condition, while those which are afforded good warm shelter in winter are seldom affected by those diseases. Another strong argument in favor of protection may be found in the fact that comfortable quarters materially increase the weight of the fleece, as well as improve its properties. Another material source of profit, induced by better condition from sheltering, is the increased number of lambs. What has been advanced in support of the policy of protection has reference only to pecuniary gain. Considerations of humanity should urge the adoption of the protection policy. If the sheep had not been tamed to man's submission, its instincts would not have led it to regions like ours. No; the God of nature would have protected it from the sufferings inseparable from northern winters by directing its wandering steps to warmer climes. Since man has appropriated it to his use, the Great Dispenser of all good requires of us that we should deal kindly towards it. The obligation is, indeed, a Christian duty, and its violation would seem to involve barbarian cruelty.

If there be any place in the world which appears to have been peculiar to the growing of wool it is Texas. The treatment of sheep in that section of country differs, in some respects, from that adopted in this wool-growing region. The shepherd does not spend the summer in preparation for the winter's food, as there is no feeding to do. The grass seldom fails in that State during any season. If, however, it should be thin and innutritious in one locality, the shepherd immediately "strikes his tent" and drives to another region, where he finds it growing luxuriantly. There are three kinds of grass in that State: sage, curly mesquite, and straight mesquite. The latter two are very nutritious,

and fatten the animals much sooner than the timothy and blue grass of Pennsylvania. Many of the stock of that State are grade sheep, having been crossed with those of coarser wool, but quite a number of fine flocks were shipped to that country in the years 1858 and 1859, and I doubt not that the day is not distant when it will be the great wool-producing region of this country.

WOOL-GROWING.

BY ROBERT GEORGE, MOORE'S SALT WORKS, JEFFERSON COUNTY, OHIO.

THE importance of sheep husbandry is only beginning to be justly felt and appreciated by the American people. Every man, woman, and child who eats mutton or wears cloth is interested in its success. But of all others, the shepherd, of course, feels the deepest interest. In rural economy, as well as in the arts, our success depends upon knowledge, industry, and perseverance; and this is nowhere more literally true than in sheep husbandry. The practical and successful shepherd is not the spontaneous product of a day, month, or year. With an experience of over forty years in this business, I very frankly confess I have yet much to learn. And having been under the necessity of making a pretty large draught upon hired help, I have only found a few men possessing in a good degree the characteristics of a good shepherd. Interest, however, in this, as in all other avocations of life, is a mighty lever, stimulating improvement and progress when nothing else will. In eastern Ohio the interest in sheep husbandry is obviously advancing. The uniform advance in the price of wool for a series of years has added much to the actual wealth of the State, as well as to the owners of sheep, having largely added to the numbers kept, and to an increase of the quantity and quality of the wool. At the present time almost every farm in eastern Ohio is more or less dotted with its flocks of sheep. I presume there are not less than 10,000 within a radius of four miles where I sit. The object of the sheep master is to produce and retain the animal which will best pay for the care bestowed upon it and the consumption of its food. But then the question immediately occurs, whether the carcass or the fleece predominates and rules the investment. This question must, of course, be decided by every one for himself, taking into view his location and the uniform demand for wool and mutton in his vicinity. For the last few years some of our most enterprising farmers have been making an effort to combine these objects in the same animal by crossing the Cotswold buck with the fine ewes common in this vicinity. Different reasons lead me to doubt the propriety of his experiment. The Cotswold is truly a noble sheep, bearing a good fleece of respectable wool, combining also the properties of early maturity, large size, aptitude to take on fat, and is really about all that the producers of mutton can desire. But I confidently believe the correct policy is to breed them separate and distinct. A number of years since I made a similar experiment with the Leicester, but, after two years' experience, abandoned it as a move in the wrong direction.

The Cotswold will pay well, if fairly and judiciously managed, yielding an annual fleece of from six to ten pounds of wool per head, and when three or four years old will weigh from 200 to 300 pounds gross. Four pounds of wool to one hundred pounds of carcass is probably about a fair estimate. This wool is about 33⅓ per cent. less valuable than the common fine wool of the country. A few years since the French variety were partially distributed through this re-

gion, and being highly recommended by those who found their interest in recommending them, I was induced to give them a trial; but these, being tested by two or three years' experience, were also abandoned. Within the last few years the Messrs. Ladd, of Jefferson county, Ohio, at much expense, imported a flock of the Silesian variety. These sheep are much admired, producing a heavy fleece of fine wool, and, by those best qualified to judge correctly, are admitted to be a very decided improvement upon the flocks common in the country. Having no experience with this variety of sheep, I cannot give the relative weight of wool and carcass. Almost all the good flocks of eastern Ohio, western Pennsylvania, and Virginia, were originally based on the justly celebrated flocks of Wells and Dickinson, formerly of Steubenville, Jefferson county, Ohio. These, however, have been crossed and recrossed, and crossed again, with Saxon, and almost everything else, until I much doubt whether there is at the present time a pure-bred Wells and Dickinson sheep in the United States, or in the world. A few years ago the Saxon mania prevailed, and a few tasty wool-growers, and those desiring the glory of producing the most superior wool, do yet and will continue to breed them, inasmuch as this is confessedly the most beautiful wool in the world. A good flock of ewes of this variety will average in weight eighty or ninety pounds gross, and will yield a fleece of two to two and a half pounds per head. At the present time, and pretty generally throughout this region, the current of popular favor is verging, or rather settling down, in favor of the Spanish sheep, or at least in a strong cross from that variety; and with this growing sentiment in their favor I fully concur. In physical form and symmetrical proportions they are almost perfection, and I am by no means prepared to grant that even for mutton purposes they are not the most profitable sheep. If it can be ascertained that an acre of grass land will produce a greater number of pounds of mutton in carcasses of from eighteen to twenty pounds per quarter than in carcasses from thirty to forty pounds, then every one must admit that the advantages are on the side of the smaller sheep. The reason of this is obvious; in times of drought and scarcity a small animal will collect for itself as much food as a larger one, and having a smaller carcass it may sustain itself, and, if equally well developed, may even improve, while the larger animal is daily losing condition. And when the period arrives at which an abundance of food can be obtained, the smaller animal is in advance of the larger and will sooner be fit for the market. But it is emphatically the wool-producing quality of the Spanish sheep which induces me to prefer them to all others of which I am warranted by experience to speak. A flock of pure blood Spanish ewes, in good condition, may average 100 pounds gross, and it is a moderate estimate to allow an average of five pounds of wool per head, besides raising a lamb. I have ewes on my farm that cut eight pounds the last shearing, and I doubt not carefully-selected and well-managed flocks of pure Spanish Merinos may be found which will yield one pound of wool for every twelve or fifteen pounds of carcass. In wool-growing, as in every other business, profit being the primary object, every one will exercise his own judgment as to the proper variety for his location and within his means. Almost every farmer in eastern Ohio is a wool-grower to some extent, while only a few make it paramount to the various other items of rural economy on the farm. Those who rear and keep but small flocks, and who make wool-growing only a secondary object, generally pay but little attention either to the true principles of breeding or to the variety of breeds kept; these persons satisfy themselves with saying that a sheep is only a sheep, and that is an end of the argument. In these mixed and mongrel flocks are often found some very good sheep; and as their range is often unrestricted, and this frequently very much to the annoyance of the neighborhood, they through the summer months become fair mutton, and for them the owners find a ready demand from the drovers. But as flocks increase in number, more care and more system becomes necessary. No intelligent, successful, and honest farmer

keeps more sheep than he can accommodate on his own premises and under his own eye, and, as a further preliminary, is careful to furnish himself with a good rifle, which is always loaded and never misses fire, as an antidote against the ravages of those packs of worthless dogs which are such a grievous drawback to wool-growing. In this latitude, or at least in this section, wool-growers generally retard the yeaning season until the grass starts in the spring, say about the 20th of April, and the usual time of shearing is from the 20th to the last of May, at which time the lambs are docked, marked, and altered. At about the age of four months they are weaned, and as in all large flocks some small and feeble lambs are found, these are passed into a separate enclosure where they can have additional attention. For many years my own flock of lambs averages from three to four hundred, and about ten per cent. of these are of that class which require additional food and attention before winter sets in; but having had the benefit of a little grain, together with an abundance of good fresh grass, they are fitted to take their place with others when brought into winter quarters. Experience has taught me that in no period of a sheep's life will it pay better to feed grain than from the time the lamb is weaned until folded for winter; and although not generally practiced here, yet I am fully persuaded a small expenditure of grain and labor in this direction pays a large interest. Very much depends upon the weather and the amount of fall pasture as to the time our sheep are brought into winter quarters. It is generally, however, from the 20th to the last of November. Various methods are practiced here in wintering sheep. That the interest of the owner, as well as humanity to the animal, are both promoted by having shelters of some kind is now almost universally admitted; but in this respect all do not act up to their convictions. Many of the smaller flocks here are wintered in the open fields, the fences enclosing them the only wind-breakers, and the clouds above them their only covering, and it is only during the deepest snows and roughest weather they receive either food or attention. A more usual method, and one practiced by many large wool-growers, is, to store their hay in large ricks in the meadows which produced it, or in fields contiguous thereto; these ricks are enclosed with a fence, leaving sufficient room for raking and pitching out the refuse, soiled, and rejected hay; and to these ricks the sheep have ingress, egress, and regress at all times. Under this system of feeding sheep, eight or ten head of young cattle to every 100 sheep are provided; these run in the meadows, and to them the soiled and rejected hay is daily fed out. Cattle soon learn to eat this refuse hay, and, when enough is given, will winter very well with no other food. The advocates of this method of feeding insist that they can make more money with less labor by this way of feeding than by any other, and between the sheep and cattle all is consumed and nothing lost. I have often wintered sheep in this way, and, provided they commenced the winter in good condition and were all strong and healthy, I have had them do very well; but for old, thin, or feeble sheep this method of feeding is not admissible, and can only be practiced with serious loss. Housing sheep, or confining them to the house and very small yards, has not been extensively practiced in this vicinity; but I venture the prediction, the more it is practiced the more it will be approved and advocated by progressive and judicious wool-growers. During the last winter, (1860–'61,) on the 20th November, I folded 300 head of sheep in the basement story of a barn 40 by 70 feet. This space was divided into three equal compartments, with a yard added to each, not exceeding one-eighth of an acre, in which is an abundance of running water. They were kept in this fold until the 20th of April, which is an unusual length of time, and during this whole period I lost but one sheep; with this single exception, the whole flock came out strong, healthy, and in good condition. They were fed good hay twice each day, and a peck of corn to each 100 head once every day during the whole season. To bring a flock of sheep into winter quarters in thin and feeble con-

dition, and feed them two or three months of the early part of winter with hay only, and perhaps this done by the boys, with little care or regularity as to the time of feeding or amount fed, and then, after that, to commence a liberal supply of grain, will doubtless hasten many of them to the bone-yard, and those having a sufficient remaining vitality to recuperate will often do so at a sacrifice of their present growing fleece. Hence it is that many persons are opposed to and prejudiced against feeding grain to sheep; while the error is not in feeding grain, but in not feeding it in the right time and in a proper manner. Under the above circumstances, I certainly would feed a little grain, but I would be governed by the same principles and general laws as a wise physician in measuring out food to a convalescent just rising from a bed of protracted sickness. I have fed corn, rye, and oats to sheep during a period of forty years; and my experience always has been uniform and perfectly satisfactory, having fewer deaths, the whole flock yielding a heavier fleece, and the ewes producing and raising a better lamb. I therefore do not hesitate to say that no animal on the farm more justly merits and more generously repays a moderate supply of grain, if judiciously fed, than the ofttimes much-neglected and hunger-bitten sheep. On farms where only a few sheep are kept, they are congregated together in a single flock; but on all farms where a number are kept, they are classified—breeding ewes, wethers, and young sheep in separate folds in the winter, and separate pastures in the summer.

The summer management is, I presume, about the same throughout the middle and western States. The principal attention given to them is to feed out salt frequently, say once a week, and to change from one pasture to another as often as the circumstances and territory of the owner will permit. All admit that frequent changes from one field to another are conducive to the thrift and vigor of the flock, even if the grass is less abundant. The migratory propensities of the sheep soon soil the grass, causing it to be rejected, and hence the importance of frequent change. In this section the wool is washed on the sheep's back. We generally practice the old method of yarding the sheep contiguous to a stream of soft, clear running water, and a clear day and warm bright sun is always very desirable, as it greatly promotes the comfort of both the washer and the sheep. The washing is usually done here about the 20th of May, and, if the weather is favorable, in from four to six days they are dry and ready for the shears. The wool, upon shearing, is tagged (or should be) and rolled up, each fleece by itself, and secured with twine transversely passed around it and firmly knotted.

For the last few years almost every village can boast of having its wool-buyers, who, on their own account or under agencies from dealers at the east, purchase all the wool of the country. Small clips are delivered and prices then agreed upon, while the larger clips are purchased and sacked at the residence of the producers.

Immense progress has been attained by judicious breeding in the last few years in the quality and value of our wool, and in the beauty of our animals; and these improvements may be extended to almost an infinite degree of perfection. From a long experience the conclusions I adopt and now act upon are, that Merinos are the most appropriate and the most profitable for this section of the Union, whether the primary object of the breeder may be either wool or mutton.

SHEEP-BREEDING.

BY JOSEPH CAPE, OF HIGHLAND HOME, NEAR WEST CHESTER, PENNSYLVANIA.

Over fifty years ago we had, on the farm on which I now reside, an Irish ram; he was imported by Captain Joseph Jefferis, of Wilmington, Delaware, who then owned and sailed the ship Neptune. My father and Cheyney Jefferis (a neighbor) purchased said ram at $40, since which time our farm has always had a small flock of home-bred ewes kept on it. My father was fond of breeding good sheep, but never practiced feeding for the butcher. Cheyney was at that time a noted sheep-feeder, and I presume not a few at this day can recollect a specimen of Charley's stock, as he was called, fed by Cheyney, the skin of which was set up and for many years occupied a place in Peale's museum, then kept in the state-house of Philadelphia. The male portion of the increase of our flock Cheyney used to drive home about weaning time; and previous to their being two years old he uniformly sold them to the butcher at from $10 to $15 per head. We often used to sell fine ewes to persons who admired them; but it was then as it is generally now, (I am sorry to say,) they were seldom taken proper care of. They were left out of hearing of their owners at night; they were worried and sometimes killed by dogs, and so did poorly; or, if they escaped the dogs, they became too fat to breed—first rate policy for a butcher to make use of, (though I never believed in it,) but it suited their interest; and the poor farmers, being generally in want of a little cash, when offered a trifle more than the price of ordinary sheep, were too easily induced to part with their best breeding stock, and thus has the breeding of good mutton sheep progressed up to the present time in Chester county.

A few years later, or perhaps about the same time, we had the Merinos introduced, some of which sold as high as $500 per pair. Wool was then considered to be the greatest object of sheep-breeding, and the finer the fibre the higher the price it brought, which probably induced speculators to introduce the Saxons, a breed altogether too tender for our climate and our poor management; nevertheless, nearly all of our Merino flocks were crossed with them, by which means I presume our wool-growers were in a worse condition than they would have been had the Saxons been left in their native country. Since then the French Merinos have been eagerly sought for and crossed with by the most successful wool-growers. They are, I believe, considered the most valuable breed of fine-woolled sheep ever introduced into this country; but I have never bred any sheep finer than the middle-woolled, having always entertained the opinion, which I have lately learned was that of the most noted of breeders, Robert Bakewell, to wit: "that mutton, not wool, should be the prime object of a sheep-breeder," and that "mere size is a vulgar test of merit;" and now the trifling difference in price between fine and coarse wools goes far towards showing the correctness of such opinions.

Soon after there had been a few of the South-downs introduced, so much was I pleased with them that my neighbor, John Worth, and I offered $100 for a ram of that breed, which had been imported a few years before. Not being satisfied without going to the fountainhead, in 1839 I visited England, (and after attending their first Royal Agricultural Exhibition, held at Oxford,) I visited John Ellman, at Glynd, in Sussex, from whom I received the most commendable hint for all spirited breeders. Upon being conveyed to a flock of four hundred yearling ewes, I thoughtlessly queried what he would charge to let me pick a couple of them; his reply was, "I never have had my flock

picked." However, after he had pointed out one to the shepherd, I pointed out another; after which, I was permitted to select my choice of all the rams that were not then let. After this, I visited Stoneham, the residence of Stephen Grantham, who was then steward to the Earl of Liverpool, of whom I purchased four ewes.

Youatt, in his history of the different breeds of sheep, states that at the last show of the Smithfield Club, in 1835, S. Grantham showed three South-downs, one weighing 283, the second, 286, and the third, 294 pounds. Such, we must acknowledge, are pretty fair weights for the little Downs which Youatt calls a "hill sheep;" and well for us it is that most of our hills produce much more abundant feed for them than does the uncultivated chalk hills of Sussex. And now I will query, Why should we not breed just as good sheep as they can in England, provided we bestow the same attention on them? I suppose many of our breeders (who generally leave the sheep to take care of themselves) will say, as is often said, "we can't have the roots." I ask, How is it that our breeders and feeders of cattle do produce as fine ones without roots as the English can with roots? Most of us know the latter to be a fact, and I believe, by paying the same attention to our sheep that they do, we can breed and feed just as good ones.

While sheep live on pastures moistened by the morning and evening dews they seldom look for water; but during the time they have to live on dry food, it is just as important they should have a good supply of good water as it is that cattle should; and while the English sheep are scooping out or craunching the frosty roots, and need but little water, ours may be feasting on the same kind of food that our cattle-feeders have proved to be as good as any that England can produce to feed on.

There are few in our country who can lay claim to being South-down breeders.

The first that I can recollect was Abner Hoopes, who was the purchaser of a small flock in which was the ram that John Worth and I had offered one hundred dollars for previous to my trip to England. This little flock was retrograding for want of judicious management; but he, being a practical man, soon brought it forward and used to sell the produce at one hundred dollars per pair. And now his son, L. P. Hoopes, breeds a small flock, and recently paid our friend J. C. Taylor, of Holmdell, Monmouth county, New Jersey, one hundred dollars for a lamb that was got by the "World's Prize," a ram bred by Jonas Webb, and imported by J. C. Taylor in 1858. He was the winner of the first prize at the World's Exhibition held at Paris, in France. Some three years previous to this John Worth paid Samuel Thorn, of Dutchess county, New York, one hundred dollars for a twin lamb about six months old. In 1859 I paid J. C. Taylor twenty dollars for the service of "World's Prize" to two ewes. In 1860 John Worth paid him one hundred dollars for the service of "Reserve" to ten ewes. Reserve was imported by J. C. Taylor in 1860, and in 1861 he imported "No. 106" and "No. 89." The latter brought the highest price of any ram sold at Webb's late sale. To him John Worth took three of his best ewes, and he also procured No. 106 for a portion of the season, and brought him to Chester county.

A flock of breeding Downs that are well kept will shear from four and a half to six and a half pounds without washing; rams and yearlings that have not bred, from seven to ten pounds. It is a rare occurrence to see a home-bred wether fed for the butcher. About three years ago I fed six pure-bred Downs; they were killed a short time before they were two years old. Three of them weighed one hundred pounds each, when dressed. I sold them at fifteen cents per pound. There are thousands of ewes brought into this county and bred one season to either South-down or Cotswold rams, and the lambs are sold to the butcher at from $3 50 to $5 per head. The ewes usually cost from $3 25 to

$4 50 per head. Wool sold this season, at shearing time, as low as fifteen cents per pound. John Worth sold good Down wool at eighteen cents. I sold the same quality lately at thirty-two cents. We almost uniformly shear without washing.

THE BREEDS OF SHEEP BEST ADAPTED TO NEW ENGLAND,

WITH SUGGESTIONS AS TO THEIR TREATMENT.

BY RICHARD S. TRAY, LYNN, MASS.

CLIMATE, soil, and market, are the three principal considerations in determining which is the best kind of sheep in any given locality. If no insuperable objection exists from the extremes of heat and cold, of excessive drought, or too much wet—if the soil produces pasturage of a proper kind in summer, and nutritious food for winter keep, the question becomes a very simple one; a reference to cattle and wool markets, and the cost of reaching them, is to be ascertained, and a breed then to be selected to suit the required conditions.

Upon the question of climate there can be but one opinion among practical and observant persons. It would be difficult to find one better adapted to sheep husbandry of a high character than New England affords, and one striking proof of this is in the fact that there is no country in which sheep are liable to so few diseases as in New England. Our rough granite hills, from which all superfluous water disappears almost as fast as it falls, and our sharp dry winds, are naturally adapted to the condition and wants of sheep, which always thrive best in the purest and most bracing atmosphere. Wet seasons and wet soils are destructive to sheep. Millions have perished from these causes in England during the last year—a calamity, unless all past experience be overthrown, that cannot occur in New England.

The reasons why sheep suffer from moist climate are obvious. The temperature of a sheep in a healthy state is higher than other domestic animals, being about 104 degrees Fahrenheit. Nothing tends to lower this temperature so long and so suddenly as the saturation of the fleece to the skin by wet; and in proportion as the temperature is lowered the sheep loses health and condition. All that he eats goes to furnish the carbon necessary to expel the cold from the system, and enough is not left to supply the other wants of the stomach. The consequence is that he sickens and dies—"starved with cold." Mere dry outward cold has little effect upon the sheep, his wool in that case perfectly protects him; and if he is occasionally thoroughly wetted by a storm, the dry and evaporating winds are sure to come quickly to his relief. All that our climate requires to guard against injury, in this respect, is moderate care and reasonable shelter at certain periods of the year.

It is often said, however, that the length and severity of our winters are unfavorable to profitable sheep husbandry, on account of the necessity of the care and shelter which is required, extending through half the year, and England is often quoted to show that the success of the flock-master there lies principally in the absence of the necessity for housing either sheep or food. This is a very mistaken idea, however, and the wonder has long been expressed by the most intelligent writers in England, how sheep could be made to pay under the wasteful system of feeding "off the land," a custom now being gradually abandoned. "Household accommodation," says an old shepherd in the English *Farmer's*

Magazine, "will not compensate for artificial food, much less will artificial food supply the place of proper housing. The two are inseparably linked together, as are the functions of the skin with the functions of the liver; and, therefore, when we improve the one we must improve the other, or the result must be a profitless balance-sheet at the end of the year. What can possibly be more barbarous, for example, than the turning of a flock of sheep into a field of turnips during winter, open and exposed to every wind that blows." The New England flock-master is forced by climate to do that which English farmers are now learning it is for their interest to do in a much less rigorous climate. The truth is, that sheep in New England, if well sheltered and furnished with proper food, will produce better wool and mutton, and a larger increase of lambs, than sheep exposed even in the genial climate of Virginia, and the balance-sheet will show a larger profit. There is nothing, therefore, in climate to deter one from engaging in sheep husbandry.

So, too, as to soil. It would be difficult to point out a fairer field for profitable sheep husbandry than New England presents. Sheep are the most indiscriminate feeders among animals. They delight in change of food. One who takes the pains to observe them when feeding will be surprised at the continual shifting they make from one species of herbage to another. Upon our hills and valleys there is to be found the full variety which their nature requires, and where it fails in great nutritive strength it is more than compensated by this varied form of vegetation. There seems also to be a principle connected with our granitic soils which is particularly favorable to sheep, giving to them hardiness of constitution and strong muscular development. This is an important fact which should be remembered when deciding upon a breed of sheep, for if it be true it widens materially the field of selection.

Having seen that the climate and soil are favorable to sheep husbandry in New England, we should next ascertain what breeds of sheep are best adapted to meet the wants of purchasers. This is more of a mercantile question than an agricultural one.

There are more sheep sold annually at Brighton and Cambridge markets, near Boston, than are raised in all New England; these are for mutton; and, allowing for difference of quality, they bring as high prices as any sheep in the world. The wool clip of New England commands a ready cash market in Boston, and the supply is not equal to the wants of the little State of Massachusetts alone, at prices greater than the same quality would fetch in England or France. We have thus a cheaply accessible market, both for wool and mutton, to an extent far beyond the supply. So varied and extensive have the manufactures of woollens become, that every pound of wool, short stapled and long stapled, combing and clothing, the finest and the coarsest, finds a ready market. These facts indicate clearly enough where the interest of the flock-master lies, which is to select that breed of sheep which will supply the market with the greatest value in mutton and wool.

Formerly flesh was a secondary object with the farmer; fine wool commanded so high a price that it paid to raise it, calling the mutton nothing. Within thirty years thousands of sheep have been slaughtered for little more than the pelts that covered them, but the case is now very much altered. Fashion has had something to do with the change; men do not wear so fine cloths as formerly. War is doing still more. Taking the operation of these two causes together, the result is, that coarse middle wools are worth almost as much per pound as Saxony and Merino. The value of the fleece of a large mutton sheep will, therefore, bring more money than a Merino, whose carcass is worth less than his pelt, and the product in lambs of the former is worth four to one of the latter at the shambles. Hence it is clear that the most profitable sheep to the farmer is one which will furnish the largest amount of marketable flesh and wool combined, and that breed is to be preferred which in the greatest degree

unites these qualities with hardiness and aptitude to fatten on our lands and under the system of agriculture existing in New England.

The writer has no hesitation, after an experience of many years, and after having visited the various breeds upon their best localities both in this country and in Europe, in recommending the Down sheep, including its sub-varieties, such as the Shropshire Downs and the Oxford Downs, as the breed best adapted to the soil, climate, and markets of New England. It is a well-established fact that, for hardiness, sheep with gray or black faces and legs are superior to white-faced ones; and the wool of the Down sheep, whether we confine ourselves to the South-downs, or extend our examination to the varieties created from this stock, is of more general use than any other description, while the mutton stands confessedly higher than any other breed whatever. There are other breeds which are likewise entitled to more consideration than they have as yet received, such as the Cotswolds or the New Oxfordshires, which are, in fact, the original Cotswold breed improved. They carry, perhaps, a greater weight of flesh and fleece than the Down sheep, and they are very hardy; but, on the other hand, the flesh is coarse-grained, and the fleece is applicable to fewer purposes, and therefore less sure of a good market. This breed is better adapted to the Middle States, where the climate is more open and the hills less precipitous, and where food is more readily obtained with less exertion. There they grow to a good size, and fatten easily. They are purchased for northern markets for mutton at high prices, because we are not yet sufficiently epicurean in our tastes to distinguish between a coarse-grained animal, if it be well loaded with fat, and one of finer flesh and higher flavor. The Cotswold, in this respect, may meet a present want, long supplied in England by the Leicesters, viz: a large leg and saddle, with plenty of fat upon it, losing sight of juiciness and wholesomeness in the flesh. "Mere size and fat," as a writer not long since remarked, "like charity, covers a multitude of sins in the way of form and substance, but it does not make good mutton." There is another important element of profit in favor of Down sheep, which is, they produce from twenty to fifty per cent. more lambs than any other breed adapted to our husbandry.

There are exceptional cases, where fine-woolled sheep can be kept in New England with profit; they may be summarily stated in the following proportion: The best soil, the highest skill, and the greatest care united, may make fine-wool-growing profitable. So, too, the very opposite of this; with a poor soil, little skill, and less care, a farmer would probably do better with a few fine-woolled animals than with a few coarse-woolled ones.

Having determined upon the breed of sheep most profitable to the farmer, a few remarks upon the treatment cannot be considered out of place, because, upon the management of sheep, whatever the breed may be, depends the profit of sheep husbandry. A manual of directions must not be expected in the brief space within which our remarks are necessarily confined, and only a few suggestions can be offered for the consideration and guidance of every flock-master in the care of his sheep. There are certain general principles which all sound experience has confirmed, and there are also particular directions to be observed in the winter and in the summer management of sheep, some of which will be noticed.

A sheep should never be allowed to fall off in condition, for two reasons: first, it weakens permanently its constitution; second, it seriously injures the clip of wool on its back. There is no animal so difficult to restore to good condition as a sheep, and there is none where a loss of flesh tells so quickly upon his outward covering.

Sheep bear the cold perfectly well. They delight in fresh, pure air, even of a very low temperature, but they suffer from moisture, especially when it is so great as to saturate the wool to the skin. It is difficult to wet them thoroughly, and it is still more difficult to dry them when wet. Sheep suffer from heat in

the summer more than from the cold of winter, and almost all their diseases may be traced to undue moisture or too great heat.

These facts teach us the importance of shelter, both in summer and in winter—that is to say, they must have pastures in summer, where either trees or artificial protection can be resorted to, and to which they can go at all times to ward off the sun's rays or the droppings from the clouds; and they require shelter in winter to preserve them from its blasts and to sustain as nearly as possible the natural heat of the system.

Sheep should be kept free from lice and ticks, which not only injure the fleece, but also materially affect their condition. A good flock-master will go over his sheep occasionally, and if any lice or ticks are found he will open the fleece and sprinkle Scotch snuff so that it reaches the skin. After shearing, every animal should be dipped in tobacco water, a good preparation of which is now manufactured; the lambs to be similarly served a fortnight later. This, if faithfully done, is generally effectual for the season.

Shearing is a very important operation, and too much care cannot be given to it. An even fleece is secured by good shearing, both of that which is taken off and the new one which takes its place. The time of shearing is likewise worthy of thought. Few shear in New England before the 1st of June—many a week or two later than this. The reason for it is that sheep are generally turned out altogether too early, and the fleece is necessary to protect them. This protection costs the flock-master a good deal of money; much of the wool falls off, much is torn off by the briars, much is injured by the various weeds, seeds, and sticks which get into the fleece after leaving the winter fold. The writer has been advancing the shearing period in his own flock gradually for several years; last year he sheared the second week in May, before turning out his sheep regularly to pasture, and he finds no reason to regret having done so. It must, however, be remembered that to enable a flock-master to do this advantageously he must continue his winter shelter for a week or two longer, turning the sheep out only in good weather and folding them at night—this is the work of a boy for an hour in the day.

Lambs dropped in February and March are worth double to the butcher, if decently cared for, those dropped in May or June. They come, too, at a time when they can be better attended to; with reasonable care a lamb dropped in winter never need be lost.

Sheep, three weeks before being put to the ram, should have artificial food, whatever the goodness of the pasture may be. Oats, oil-cake, or cracked corn, at the rate of half a pound per ewe, given at night, will increase the fecundity of the flock materially, and produce better lambs. After receiving the buck, the feed should only be such as to keep them in good store condition until within three weeks of lambing, when more liberal feeding should commence.

Washing sheep previous to shearing is not recommended. The flock-master gains nothing by it in price, the shrinkage in weight from washing being equal to the increase of price, without any compensation for the loss arising from drenching sheep with water at the most critical season of the year.

Weaning is a matter too little attended to; four months is the length of time for lambs to suckle. They should then be widely separated from the ewes. The flock-master should go over the flock at least once in two days after the separation, and milk moderately every ewe where the bag shows any distension.

The ram should never run with the flock. The better plan is, when the period of serving arrives, to fold the sheep at night, and put the ram in with the flock, or a portion of them, if it be desirable for any reason to have any priority among the ewes in early lambing, The best flock-masters put the oldest ewes to the ram first. By smearing the ram between the fore-legs with lampblack or other pigment, those which have been served are readily distin-

guished. A ram well fed, and treated in the manner as above stated, will serve fifty in a season without impairing his health or vigor.

There is no department of sheep husbandry more difficult and requiring the exercise of a sounder judgment than the

WINTER MANAGEMENT.

The first mistake frequently made is to keep the flock too long at pasture, with no other food than what the pasture affords. The change from the pasture to the fold should be gradual; that is to say, the sheep should be allowed their usual range abroad as long as the ground is not covered with snow; they, as well as the mowing fields, will be benefited by an occasional run over them. After the severe frosts of October, however, the herbage, even if abundant, loses a part of its nutritive qualities; and when this is the case, it should be made up by artificial food. This period indicates the time for folding at night. Sheep should then have, before going out in the morning and on their return, the needful addition to their pasture food. Crushed corn, oats, beans, oil-cake, or roots, in very moderate quantities, will keep sheep at this period in good condition, aided by what they get during the day from the field, and prepare them for their regular winter treatment.

The fold is a matter of some importance. It is a very cheap and simple business to house sheep in the winter; at the same time there is a right and a wrong way in going about it. Cold is not so much to be guarded against as wet. A plenty of cover, therefore, with yard room, is essential. They must always have a retreat from snow and rain. At the same time they should not be deprived of the open air, when they desire it. There is scarcely a farm in New England that has not waste barn-floor room in which to winter forty or fifty sheep. A yard opening from it is easily and cheaply constructed. A portion of a cellar under the barn, open at one end, with a small enclosure attached to it, makes comfortable quarters for sheep. The manure from sheep can be left through the winter where it falls, provided coarse litter or dry sand, or both, is occasionally sprinkled over it. Ventilation or fresh air is essential to the health of sheep. This and dryness are the two leading objects to aim at, bearing in mind the old adage: "One-third more shelter, one-third less food."

Next in importance to proper folding is the feeding. Here, too, the profit or loss depends less upon the quantity than in the method of its distribution. Regularity in the time of feeding, and variety in the food given, are essential.

Sheep should be fed, when in fold, at least three times a day, and always at the same hour. No animal knows better than a sheep his usual meal time, or is more impatient of its postponement. The appetite comes with the appointed hour, and the food is then eaten with the greatest relish and the least waste.

Every observant flock-master knows the fondness of sheep for variety in its food. It has been said that it cannot exist long upon any one kind of herb, or root, or grain—not even upon the turnip. Change in food, in order to preserve the healthy condition and well-doing of sheep, is, therefore, a necessity. The following extract from an article in the Transactions of the Massachusetts Society for Promoting Agriculture, vol. 1, No. 2, new series, contains all that it is necessary to say upon this head:

"The kind of food supplied to sheep is of hardly greater importance than the method of giving it. Sheep are powerful digesters, and are capable of converting the driest and coarsest herbage into food, and to extract from it more nutritive matter than any other animal; in proportion to their weight, they will consume, therefore, a larger amount in bulk. The instinct of sheep leads them, accordingly, to select high and dry grounds, and to range widely, feeding upon every variety almost of herb and shrub. Linnæus found, by offering fresh plants in the ordinary mode of feeding, that horses ate 276 species, and refused 212; cattle ate 276 species, and refused 218; while sheep took 387 species, and only refused 141. I have taken advantage of these facts in my winter management of sheep, giving them a

fair amount of nutritive food of every kind that it was good economy to use to keep them in condition; but whatever the kind might be, I make it a point to add enough of coarse and bulky nature to keep their bellies full. My practice has been to feed three times a day—in the morning with good hay; at noon with one of the following articles: Swedish turnips, ruta-bagas after January, carrots, oats, Indian meal, cotton-seed oil-cake, varying the kind given as often as possible, according to my supply; at night a full supply of wood-waxen, as we call the plant which infests our pastures, a species of broom, and which no other animal will eat. This I mow in August, as it grows in the pastures mixed up with briars and every other foul weed. They eat it with a relish, and thus convert my brambles and weeds into food and manure. This is my winter treatment, always taking care to keep the flock supplied with water and with shelter. In many years' experience, I have had so few cases of loss from disease that I should have to put the percentage down to a fraction, too small to be worth mentioning."

The following table represents the value of different articles of food which may be given to sheep, taking hay of the best quality as the standard:

100	pounds of	hay, best quality,	is equal to	90	pounds of clover.
Do	do	do	do	102	do aftermath.
Do	do	do	do	374	do wheat straw.
Do	do	do	do	442	do rye straw.
Do	do	do	do	195	do oat straw.
Do	do	do	do	153	do bean straw.
Do	do	do	do	339	do mangel wurtzel.
Do	do	do	do	504	do common turnip.
Do	do	do	do	276	do carrot.
Do	do	do	do	308	do Swedes turnip.
Do	do	do	do	45	do wheat.
Do	do	do	do	54	do barley.
Do	do	do	do	59	do oats.
Do	do	do	do	50	do maize.
Do	do	do	do	45	do peas.
Do	do	do	do	45	do beans.
Do	do	do	do	105	do wheat bran.
Do	do	do	do	167	do wheat and oat chaff.
Do	do	do	do	45	do linseed oil-cake.
Do	do	do	do	44	do cotton-seed oil-cake.

The return in manure, which is not taken into account in fixing these values, is largely in favor of the oil-cake and other highly nitrogenized substances.

A sheep should receive daily about three per cent. of his live weight in food; if, however, it consists of hay and other coarse herbage a liberal allowance should be made for waste. Taking the above formula as a guide, one pound of good hay, half pound of maize, and two pounds of oat straw would be a fair allowance for a sheep weighing one hundred pounds, the three being equivalent to three pounds of hay, or three per cent. of its weight. Observation and practice will soon correct over as well as under feeding, the great object being to keep every animal in an improving condition.

It is not a good plan to fold too many sheep together, and the breeding ewes should be kept apart from the rest of the flock. Thirty or forty sheep are as many as should be together for health and economical feeding. It is not absolutely necessary that each lot should be kept in separate buildings; but the lots ought to be so divided that they cannot run, feed, or lie down together.

Water should be carefully supplied to sheep, and a box of coarse salt should be placed in every fold.

SUMMER MANAGEMENT.

The same reason which makes it imperative not to bring sheep into the winter fold too suddenly is equally strong for preventing their abrupt ejection from it

to the pasture. Sheep are benefited by being allowed to range over the fields in good weather for a portion of the day, long before they should be expected to lie out or to get sufficient nutriment from the pasture for their wants. This is especially the case with ewes which are about to lamb, or which have already lambed. When sheep are turned out in this manner they should have a morning feed of hay as usual, or of roots; the noon meal alone may be omitted, but they must have another feed at night, which ought to be of a concentrated nature, such as grain, beans, peas, or oil-cake.

Once fairly at pasture, which should not be until the grass has well started, little care is necessary beyond a daily overlooking. This is essential, because accidents frequently happen, both to sheep and lambs, which entail loss and disappointment; much of which might be avoided were they known in season.

Under judicious management pastures are improved by sheep, but both sheep and land will suffer unless due attention is given to them. Over-stocking and continuous stocking, as it has already been said, are highly detrimental. Sheep are indiscriminate feeders; they require variety. They will eat a little of almost everything, but they will not eat much of any one thing with a relish. They go from the sweetest clover to the bitterest white weed, and will nip the pine boughs while standing on the most succulent grasses. As this variety is reduced, both by constant use and by over-stocking, the pasture becomes less palatable, and if the sheep are not removed for a time they will not thrive, but will seek to escape to other fields. Sheep can be kept on half the number of acres divided into two or three parts, if they are removed every three or four weeks from one to the other. In this way such an improvement to the pasture will be effected, that where one hundred were kept one year, it may be considerably increased from year to year until the number is doubled.

Where the farm admits of it, if cattle are likewise kept, it is an economical and improving system to divide the pasture land into five or six fields, giving the cattle the first run over them successively, to be followed by the sheep. Thus, if there are five pastures, three would always be at rest.

The number of sheep to an acre that can be profitably sustained upon an acre depends upon its quality. Five sheep are usually considered equal to one cow. This must be left to the judgment of the flock-master. It is a good plan to weigh and mark a few sheep in every flock, both when brought into the fold in the autumn and when turned out in the spring; an occasional trial upon the scales through the summer will show whether the flock is doing well, and enable the flock-master to correct whatever he finds amiss either in the stocking of his pastures or artificial feeding in the fold.

CONCLUSION.

There is nothing in agriculture which is more difficult of explanation than the decline of sheep husbandry in New England. Why is it not the leading department in agricultural industry? Compare the advantages of the sheep-grower over the cattle-breeder, and they are so apparent that it seems strange they should not long since have been fully appreciated. Look at sheep as producers of food; look at them as the producers of clothing; look at them as improvers of the soil; and yet they are a neglected animal. Never were truer words spoken, or more applicable to New England, than those of Mr. Grey, of England, when he said to the Hexham Farmers' Club: "The wealth and success of a farmer may be pretty well calculated by the amount of his sheep stock. Sheep are said to be the animals with the golden hoof; they enrich where they go. They not only enrich the master, but the soil. Their manure has a peculiarly efficacious quality, and it is distributed throughout the land in a way very different from that which is left in patches by horned cattle; but there is this also, that while you have the mutton, probably as valuable per pound at the end of the sheep's life as beef, it has given you, year after year,

the fleece, which is of itself so important, and which, in the progress of manufactures in this country, I think we have no reason to fear ever seeing again at a disastrous price."

Keeping a few sheep to roam without overlooking them when at pasture in summer, and to pick up a scanty subsistence in winter from the refuse stock of the barn, is not sheep husbandry. It is, however, too common thus to treat our sheep. This will not pay, and farmers find that it will not do so; instead, however, of better treatment and greater attention, by which a good profit is assured, they are too apt to abandon sheep as a profitless animal. There is no animal which rewards its owner more generously for the food, shelter, and care extended to it than the sheep.

SHEEP AND WOOL OF STEUBEN COUNTY, N. Y.

BY T. M. YOUNGLOVE, HAMMONDSPORT.

THE growing of sheep has long been a favorite branch of husbandry in this locality. The uneven surface of the country presents the variety of scenery and climate which are most favorable to the growth of sheep, and which tend to the health and vigor of the animal. During the past thirty years the united, careful, and vigorous attention of a large class of our most industrious and thrifty farmers has been directed to the raising of sheep, with especial reference to the grade and weight of fleece, and the form, size, and hardy constitutional structure of frame. These highly-prized qualities were found in the greatest perfection in the Spanish Merino, and to that breed the attention was early turned as forming the basis of future operations.

About the year 1828 some Saxony rams were imported direct from Germany, which were crossed upon the Merino ewes. The diminished size of the stock, together with the slender and frail form and diminished quantity of wool, soon rendered it apparent that it was not a proper cross for this region, and was consequently abandoned as soon as the stock so far developed that its peculiarities became known. The enhanced price of the wool was comparatively little remuneration for the lack in quantity and the increased amount of attention necessary to be given to a flock of Saxony sheep. A speedy return to the favorite Merino was the result.

About the year 1833 and 1834 the average clip of wool per head was about two and one-half pounds. Since that a steady and united effort has been made to improve the Merino, and the result proves that the effort has not been in vain. The average weight of the fleece is now fully four pounds, while the weight of the carcass has not been materially increased. The average of carcass at shearing time, which is the month of June, may be estimated at between fifty and sixty pounds. The aim of good breeders is, that every ten pounds of carcass must yield one pound of good merchantable wool. While many have succeeded in reaching and even passing this desirable result, the majority have not yet succeeded in acquiring this state of perfection. Some trials have been made with the different families of Merino. The French Merino were too large and coarse-framed to be capable of a high state of cultivation in the fleece. The Pauler Merino has many good points which have been grafted upon other acceptable species of Merino, and has entered into and become a part of the standard flocks of this vicinity.

The peculiar build of the sheep grown here (I mean the well-bred flocks) are, that they are close-built, leg, neck, and head short, well ribbed up, with girth large in proportion to the other measurements, and, upon the whole, rather small than otherwise. Large size and over growth are particularly discarded. Many are covered, particularly about the neck, with loose folds or wrinkles of skin, thereby giving greater surface for the growth of wool, which should cover every part of the sheep from the hoof to the nostril. No place should be left without this thick and close covering. The wool is usually supplied by Nature with an abundance of yolk or animal grease which runs out upon the wool to the surface and there forms a smooth, dark, and even surface or crust almost impervious to water. Some sheep have an abundance of this yolk diffused all through the wool, so that when a fleece is folded it has the appearance of being wet. This latter is not deemed so desirable, as it seems to be a drain upon the animal without any material benefit, except to furnish weight for the purchaser.

PROFITS.

I know of no more definite way of arriving at the profits of wool-growing than to refer to the common custom of letting sheep. Occasionally a flock of ewes are let to double in three years. This is an annual interest of 33⅓ per cent. The more common practice is to let them for two pounds of wool per head annually, returning the original number. Assuming the ewe to be worth three dollars per head, and the wool at an average of forty cents per pound, it gives eighty cents for the use of one sheep, or 26⅔ per cent. This is certainly a very good interest for the owner of the sheep. Now let us see what the taker has for his care and trouble. With reasonable care he can count upon raising three lambs from every four ewes, or 75 per cent. increase; which, if worth one and one-half dollars per head, would be $1 12½ cents per head for the increase of each ewe. This, added to the wool left after paying the two pounds to the owner, (assuming that they shear four pounds,) is eighty cents—making one dollar and ninety-two and one-half cents for his portion. The cost of keeping a single sheep for the entire year is variously estimated at from one dollar to one dollar and fifty cents per head. Taking the highest figure, it still leaves over forty cents clear profit, after paying the owner over twenty-six per cent. annual interest. But this is only upon a flock of breeding ewes, which may be set down as about two-fifths of each flock. The other three-fifths will only a little more than pay for their keeping. Allowing them to shear four pounds, at forty cents, gives one dollar and sixty cents. But this portion of the flock will shear more in proportion to their weight of carcass, and require much less care and attention than the breeding ewes.

BREEDING.

Upon this branch of wool-growing very much depends. Upon the form of the carcass depend not only the powers of endurance, but the capability to produce the greatest possible amount of wool to the least weight of carcass. It is quite as impossible to put a strong and healthy constitution as it is to put a heavy fleece upon a sheep with long, slender legs and neck, and a thin, lathy, loose body. In order to secure the many desirable good qualities which go to make up a first class flock of sheep, great care is taken in the selection of a buck with reference to the particular flock of ewes with which he is to be put. As one buck is sufficient to serve from one to two hundred ewes, very much depends upon him, as he is to impart, in a great measure, his qualities to the entire flock. Some bucks, although possessing all the desired qualities of form and fleece, yet fail to infuse into their stock those many good qualities, and are, therefore, rejected as not good stock bucks. But when one is found that seems to impart all the valuable qualities of the sire to the entire stock, he is termed a

decided stock-getter, and is prized accordingly. One hundred dollars is not deemed an excessive price for a good stock buck. In some cases fancy prices even beyond this have been paid. It is not uncommon for a buck in prime of life, weighing from one hundred and twenty-five to one hundred and fifty pounds, to shear twenty pounds annually of unwashed wool. Bucks that are valued highly are not risked the exposure of a cold bath for the purpose of washing the wool upon the sheep. Constitutional defects of body or fleece in a flock of ewes can easily be corrected by using a buck that shows strength where the other is weak.

TREATMENT OF THE BUCK WHILE WITH THE FLOCK.

A common custom is to turn the buck loose with the flock of ewes which he is desired to serve, and to give them no further attention. This will do very well where only a few ewes are to be served by one buck; but when it is desired to have one buck serve a large number, it may be done much more effectually by keeping the buck up, and ewes only taken to him when in heat, such being selected from the flock, by the aid of a buck, with an apron called "a teaser." Some allow the buck to run with the flock during the daytime, and keep him up through the night. From observation of the different modes, I think the better way is to allow the buck to run with the ewes from the time the flock is brought to the yard at night until they are turned away in the morning, and to keep the buck in the stable during the day. This gives the buck an opportunity to go through the flock before they lie down at night and again in the morning, and not only the buck, but the whole flock of ewes are allowed to feed at their leisure through the day. There are few males in the whole of the animal race more cruel or abusive to the female than the buck, for he will follow and butt or hook until both are worried down. From this practice an observing breeder will readily see that extraordinary exertion of the ewe brings her readily to the wants of the buck. In case it is desired to have the ewe ready for the buck when put together, it can easily be effected by driving the flock of ewes briskly for a half or a whole mile before being brought to the yard. They will then be found in a particularly pleasant mode. If the buck is stabled, and the ewes brought to him in this manner, he is saved much labor, and will consequently serve more ewes in a given time without fatigue or exhaustion of the system than if allowed to run with the flock. A buck treated in this manner will serve one hundred ewes without materially impairing his condition, and the offspring will be as strong and healthy at the close of lambing as at the beginning.

SEASON FOR DROPPING.

Lambs should be dropped at the particular season when the ewe first obtains a scanty supply of grass, and consequently must be varied in different localities. If allowed to drop earlier, the ewe gives but a poor supply of milk, many of the young ones and those in low condition none at all. In this case many of the ewes that have no milk will refuse to own the lamb, and many of the lambs get a stunt of which they recover, if at all, but slowly, and the flock will be of all sizes. If allowed to drop later in the season, when the ewe has obtained sufficient grass to enable her to give a flow of milk and the whole system becomes invigorated by it, the offspring too often attains an over growth, so that even the services of the most skilful midwife are not sufficient, and frequently both mother and lamb die from this cause. Another serious difficulty of late lambing is, that unless the lamb draws both teats soon after its birth, the ewe suffers from an over abundance of milk, and frequently inflammation follows.

CASTRATION.

The lamb should be castrated at from one to three days old. The lamb should be held by an assistant, who should set the lamb upon his back just back of the hips, taking the fore and hind legs of each in each hand, putting the fore legs outside of the hind, and hold them firmly just above the knee joints. The operator takes hold of the pouch and pulls it gently, so as to get as much as possible of it, and then with a sharp knife at a single stroke takes off the pouch pretty close to the testicle. Then take a firm hold of each testicle separately between the fore finger and thumb of the right hand, and pull it out with all the cord that adheres to it. This completes the operation. The reason for cutting off all the pouch that can be easily pulled beyond the testicle is, that it leaves a much evener surface for shearing than if only a little is taken off. This operation should be performed in the morning, and the lambs then turned out to move about, which will in a great measure prevent any disposition of swelling or stiffening of the parts, which is frequently the case if they are allowed to lie still for a time afterward.

DOCKING.

This should be done as soon as they are well of the castration, generally about three days afterward. This operation should be performed with a single stroke of a sharp knife, and in the evening, allowing the flock to lie down and keep quiet and still, so that they may lose the least possible amount of blood. By morning the wound will be sufficiently dried that no fear of bleeding need be entertained unless by accident. In no case should they be driven or put to any extra exertion immediately after being docked, for if so, many will bleed to death. If these hints, which are simple and easily put in practice, are carefully heeded, not one lamb in a hundred need be lost by both operations. At from ten to fifteen days old he should be entirely well of both, and allowed to go on his way rejoicing that all the ills of life are past.

WEANING.

At about three months old the lamb should be taken from the ewe. The flock should be brought to the yard in the forepart of the day and turned away just at evening, while they are hungry. Much anxiety of both is avoided by this simple practice, for both flocks will go quietly to feeding, and finally lie down satisfied, which they would not otherwise do. The lambs should be picked from amongst the ewes and allowed the liberty of a larger yard, while the ewes are kept more closely confined during the latter part of the day—the two flocks separated by a sheep rack or open fence. The lambs' yard should be furnished with a feeding trough supplied with a mixture of salt and bran. This is very palatable, and they will learn to eat from a trough the same day their supply of milk is taken from them. This yard and trough should be convenient for the flock of lambs to run to, and should as often as twice a week be supplied with something palatable, which learns them to eat from a trough, and goes far towards taming and attaching them to the shepherd. If the yard is not contiguous to the pasture, the trough may and should be moved to the pasture where the lambs are to make their future home. As the season advances and the nights become frosty, or during heavy storms, the flock of lambs should be herded and the yards supplied with racks and troughs sufficient for them to feed without crowding too much. Occasionally a little hay or oats in the sheaf should be put in the racks. This learns them to use the yard and rack ere it is needed, and when the first severe storms of winter shall cover the whole earth as only a cold winter storm can do, they will take hold with a keen relish. If they are left in

the field until the winter sets in and makes it necessary to fodder, they are brought to the yard strangers alike to the arrangements and the food they are to use. Many will become discouraged and stand with drooping head and ears, and will only eat when reduced to a reeling skeleton. They thus begin the winter under serious disadvantages and frequently never regain it, but drag along a miserable winter, toppling over every obstacle, to be lifted to their legs, and finally die, as the first warm days of spring take from them the miserable remnant of appetite which idly lingered about them. This negligence in the early education of the sheep is like neglecting the education until the tender and pliant years of childhood are past. When the fully-matured man acquires a business that must be done, he sets about learning to do it. There is, however, this difference: the man can get a competent person to do it for him, but the unlearned sheep can get none to eat for him that will supply the wants of nature. When the lambs are fairly in their winter quarters, their education may be considered complete, as their treatment in the after part of the winter may be in every respect like older sheep, only a little more care and attention; and like older ones, grain is not lost upon them, although too high feeding is not recommended.

WINTERING.

During the winter, care should be taken not to allow too many to run in one flock, for the stronger continually overrun the weaker, picking out the most delicate portions of the food, and leaving that less palatable and of inferior quality to those which should have the best. The usual mode is to allow from one hundred to one hundred and fifty in a flock. While some keep them in close yards and water and feed them, others allow them to roam over the fields during the day and bring them to the yard at night. Such as are allowed a free range usually pick quite a portion of their winter living, but it is of an inferior quality, and a flock allowed to roam will not usually keep in as good condition as when they are carefully yarded, housed, and properly fed. If sheep are divided into small flocks of about twenty-five, and are selected with reference to size and strength, and kept in close confinement through the winter, giving them only room enough to move about, they will require less food than if allowed more liberty, and allowed to run in larger flocks; but whether the increased amount of labor will offset against the difference in the supply of food can only be determined by the circumstances and conveniences of the grower.

TAGGING.

Before the sheep are changed from hay to grass in the spring they should be carefully looked over, and all horns and hoofs that threaten to be troublesome carefully removed. The hoofs can be taken off with pruning shears, but a fine saw is needed for horns. The sheep is then laid upon his back in a kind of saw-buck, with a board nailed to each side, forming an easy place for the sheep to lie, and convenient for the operator. It should be high enough for the sheep to run under without oversetting it. A basket is then placed at the end to receive the tag-locks as they are taken off. A portion of the wool should then be taken from the stern of each sheep in such a manner as to allow the manure to drop free without finding any stray locks or loose raw edges of wool to obstruct it in its passage. The wethers should have a small portion of wool removed from the belly, to allow the urine a free passage. This is quite as important as any part of tagging, and yet is neglected by many. When the entire flock have received this attention, they are ready to be changed from the yard to the pasture.

WASHING.

This is performed by immersing the sheep in a vat of water fitted for the purpose, or some deep place in a running stream. When the sheep is thoroughly wet it is turned upon its back, and the wool (particularly on the neck and belly, where most of the dirt accumulates) is squeezed until the water runs clear from it, when it is turned loose, and another is treated in the same manner. A skilful man will usually wash one in about two minutes. They are then turned into a clean pasture.

SHEARING.

Shearing follows soon after washing, but, as so much depends upon the weather, no definite time can be fixed. The sheep should not only be thoroughly dried, but they should have time to have a small portion of the animal oil diffused through the wool, which requires warm and dry weather. If this animal oil is entirely lacking, which is the case when the wool first becomes dry, it renders the wool harsh and coarse to the feel, very unlike what it is when it becomes softened by a supply of this natural oil, so necessary to put it in desirable condition. Shearing should never be performed except in warm and dry weather. Each fleece is carefully folded by itself, excluding all tags, filth, and worthless rubbish, and wrapped with twine when it is fit for market. In the operations of folding, it is well to avoid pressing the wool or winding the twine too tight about it, as it will have a tendency to make wool appear heavier than it really is. It is expected by the purchaser that the wool will be so done up and fitted for market as to show the very best part of the fleece; and when the wool is left a little open and free, it will present that peculiarly lively, free appearance, pleasing and attractive to the purchaser.

SELLING.

As no horse is led from a filthy stall, without grooming, to the market, so no wool should be offered without proper care. But few growers suffer from this want of care, for the wool is frequently purchased by buyers who are entirely ignorant of the difference in quality or condition. The buyer is usually selected by the manufacturer or speculator more for the gift of tongue or tact in making a bargain than a knowledge of the article they are to purchase. They usually repeat a learned lesson to startle the wool-grower, or at least arouse his fears, and endeavor to convince him that unless he sells now he will hardly find another chance. He tells of the "number of mills which have closed within a few weeks past, on account of the heavy arrivals of cloth from England, France, or Germany—the very recent heavy arrivals of fine wool from Australia and coarse wools from South America, of much improvement in such coarse wools, or some particular change which has been or is just to be made in the tariff"—all of which is certain to materially lessen the price of wool. They are usually limited to a fixed figure, above which they are not to pay, and to which they readily come, without much regard to quality or condition. The filthy, careless, and slovenly here receive a rich reward for every worthless particle that is hid from the most casual observer. If the growers could depend upon such purchasers every time, they might trim accordingly, but it is not so. Occasionally a purchaser makes all the difference in price that he finds in grade or condition. I think it would be well if there could be an understanding between the growers and consumers, so as to have the wool shorn without washing. There would then be much less difference in condition. Many wash so slightly that it is really a matter of doubt whether it has been washed at all, and consequently much dirt goes with the wool. Some standard should be fixed, so that care and attention in getting up wool clean and

desirable might be properly rewarded. Let it be understood that the sheep are shorn without washing, and then all that will have to be attended to by the buyer is, that no undue proportion of tags are allowed to be stuffed in the fleece. There are very few wool-growers that will descend to such a practice, but the stimulus to slight the washing is so great that few are desirous of getting their wool very much cleaner than passable. If one succeeds in putting his wool in better and cleaner condition than all the others, all the reward he gets is a few words of praise from the purchaser, for which he pays dearly in the lessened amount of wool.

DIFFERENT BREEDS.

Some experiments have been made with the different families of coarse-woolled sheep, such as Bakewell, South-down, and Leicester, but they have been of short duration, and without anything particular to recommend them to others. They do not seem to thrive in large flocks, and only fully develop when they receive extraordinary care, and under high feed.

DISEASE.

The only diseases which are dreaded by growers is foot-rot and scab. They are both contagious, and both yield readily to proper treatment if thoroughly applied. It is no small job to cure a flock of either disease, and, consequently, if one is desirous of ridding himself of this unpleasant and tiresome task, (for nothing but untiring vigilance will accomplish it,) he must not allow his sheep to become exposed. Our immediate neighborhood has been very much exempt from such disease, and the flocks have universally been healthy. Sheep, when they become advanced in years, and there is any need of extra care, should be well fed on ground feed through the winter, and either given over to the butcher in early spring, or soon after shearing. They should generally not be kept beyond the sixth or seventh year, although many will do well much older. There is no other stock that pays a yearly net profit unless it is milk cows, and they pay nothing unless attended with much daily labor. Sheep require little or no labor or care, except such as can be put over to suit the convenience or inclination of the grower, and can therefore be performed at leisure.

WEIGHT.

The weight of carcass is probably between fifty and sixty pounds, while that of the fleece is about four pounds. This shows that there is yet ample room to increase the fleece from one to two pounds over what it now is. All of the increase of fleece may be put under the columns of profits, for it is not certain but a sheep weighing sixty pounds, and shearing but three pounds annually, will consume as much as though he sheared six pounds. I do not assert that this is so, neither do I think the amount of keep which the sheep requires depends so much upon the amount of wool he shears as upon the constitutional form of body and limbs. That a certain amount of food is required to enable the animal to produce a required amount of wool is evident; so it is to maintain life. The reason why some animals, like some men, require much more food than others, is perhaps difficult to determine; neither is it of importance here. The aim and determination of every breeder should be to cultivate such sheep as will shear the greatest amount of wool and consume the least amount of produce. So that by lessening the expenses of keeping, and increasing the annual income, it may afford a double profit to the grower.

PRICE.

The price of wool usually averages about forty cents per pound. The price of wool is varied by so many contingencies that the great mass of growers are unable to keep themselves posted so as to judge of the price in market and its relative value one year with another, and it is not unfrequently the case that a portion of the wools are sold at twenty cents above or below this average. A fixed understanding between the grower and consumer, or a standard as to condition in which the wool must be in order to enter the market, would result in a great benefit to both, and would go far towards equalizing all the wools sent to market.

ARTIFICIAL MANURES.

BY PROFESSOR C. UPHAM SHEPPARD, OF CHARLESTON, S. C.

I SAY nothing here of the use of ordinary animal manures, of guanos, and super-phosphates. The former are pre-supposed; and the latter are to be employed in addition, though with much judgment, somewhat after the manner of peptic persuaders in diet. I would not be understood as discountenancing their use; far from it—I am strongly in their favor; but I must insist that those who use them should know more about their composition and the uses they are capable of rendering. Employed even as they now are, with very little knowledge, they are found to be profitable, or it is presumed the demand for them would not go on increasing so rapidly as it does. But I hazard nothing in affirming that their misapplication deprives them of affording one-quarter the advantages they are capable of yielding to the consumer. They are sometimes applied alone and without mixture with ordinary manure; at others, preparations, not strictly compatible with each other, are used together, whereby the virtues of one or both are nearly lost; the crop is sometimes over stimulated at the start, and then left to suffer for nutriment at a subsequent period.

Need I speak of the many quack nostrums and adulterations to whose use the planter is liable? These come very readily to the knowledge of the chemist who is led to inspect such preparations, and he is sometimes compelled to look upon the man who is trusting his seed to some of these saline preparations alone, in hopes of a harvest, as in a condition scarcely more hopeful than that of the child who expects to catch birds by sprinkling salt upon their tails.

Perhaps it may appear unprofessional for a chemist not to trust more entirely to artificial manures. For one, however, I believe in them only as auxiliaries to production.

The farmer's main reliance must ever be upon common manure. Nature has ordained that he shall wait humbly upon the dissolution of organic matter, and especially that he shall convert the digusting exuviæ of animals into forms of beauty and utility; and she has established it as fundamental that if he would thrive he shall watch with unceasing care upon the fixation of every nauseous exhalation.

His success in his calling makes him the ever-watchful sentinel upon putrefaction. Here is the mine in which is to be found his principal wealth; and the time is not distant when, aided by the chemist, he will be able to appropriate

with facility all the organic refuse of our larger towns, which at present we are striving to pour, by costly under-drains, into our rivers and harbors. I am aware that this view is liable at the present day to be partially set aside, and I will, therefore, dwell a few moments upon it, with the hope of impressing its importance upon those who are immediately concerned in agriculture.

In support of my opinion, I beg leave to adduce the words of Boussingault, one of the highest chemical and agricultural authorities, a member of the Institute of France, and a companion of Boit and Dumas. He says: "Soils, to become productive, require the intervention of manure; for this there is no substitute, neither the labor which breaks them up nor the climate which so powerfully promotes their fecundity, nor the salts and alkalies which are such useful auxiliaries of vegetation. Particular cultures may require particular manures. But farm dung, when it is derived from good feeding, supplied to animals with suitable and abundant litter, affords all the principles necessary to the development of plants, and such manure contains at once all the usual elements which enter into the organization of plants, and all the mineral substances which are distributed through their tissues; in fact, carbon, nitrogen, hydrogen, and oxygen are found therein, united with the phosphates, sulphates, chlorides," &c. This being my own conviction, I have uniformly said to persons consulting me upon the subject, make all the manure you can from your animals, your straw, your leaves, your swamp mud, ashes, soot, and small charcoal. Let not a disagreeable odor escape from offals of any description. Neglect not dead animals that have perished by disease or accident, whether large or small, from a horse to a chicken. Have capacious receptacles prepared for whatever can be converted into manure. Let the bottom of these pits be lined with clay or water cement, and the surface screened from the sun. Into these cast all manner of animal or vegetable refuse, taking especial care to enrich the aggregate by additions of the liquid drainings from the stables and of urine from the houses. Remember that a gallon of this last is often worth a barrow load of what is called cattle-pen manure, prepared as it now is over large sandy areas exposed to the full action of the sun. The tests for the proper management of these artificial manure pits are, that the nose shall detect no gaseous emanation from their surface, and that no water shall trickle away from beneath that shall possess either color or flavor. It has always struck me that there exists great improvidence on plantations as to the preservation of animal manures. Night-soil seems to be unknown. Why is this? Is the cultivator ashamed to utilize substances which constitute elsewhere the peculiar wealth of the agriculturist? Let us not forget that the grand duke of Tuscany enjoys the much-envied monopoly of all the privies of Florence; or that the Chinese, who are the best agriculturists in the world, owe their success to the almost religious care with which they treasure up every species of animal reliquiæ. Hog-pen manure with us is totally neglected; and the crops get no nitrogenized material from either of the sources here referred to, while the fixed constituents belonging to such matters are so broadly scattered as to be almost wholly useless. When all animal matter within reach has been secured; when the straw, bones, and vegetable trash of every description has been duly husbanded; when marl, if accessible, has been liberally applied, both in its natural and calcined state; when all this has been done, then, I would say, engage freely but intelligently in the use of guanos and manipulated fertilizers; but until then I would counsel reserve and caution, lest under the prevailing neglect of genuine manures, and the substitution therefor of artificial compounds, you complete the destruction of lands already much wasted, and bring about, at no distant day, a sterility as hopeless of redemption as the deserts of Babylonia and Assyria.

BELT OF NO FROST, OR THERMAL BELT.

BY SILAS M'DOWELL, OF FRANKLIN, MACON COUNTY, NORTH CAROLINA.

Amongst the valleys of the southern Alleghanies sometimes winter is succeeded by warm weather, which, continuing through the months of March and April, brings out vegetation rapidly, and clothes the forests in an early verdure. This pleasant spring weather is terminated by a few days' rain, and the clearing up is followed by cold, raking winds from the northwest, leaving the atmosphere of a pure indigo tint, through which wink bright stars, but, if the wind subsides at night, the succeeding morning shows a heavy hoar frost; vegetation is utterly killed, including all manner of fruit germs, and the landscape clothed in verdure the day before now looks dark and dreary.

It is precisely under this condition of things that the beautiful phenomenon of the "Verdant Zone" or "Thermal Belt" exhibits itself upon our mountain sides, commencing about three hundred feet vertical height above the valleys, and traversing them in a perfectly horizontal line throughout their entire length like a vast green ribbon upon a black ground. Its breadth is four hundred feet vertical height, and from that wider, according to the degree of the angle of the mountain with the plane of the horizon. Vegetation of all kinds within the limits of this zone is untouched by frost; and such is its protective influence that the Isabella, the most tender of all our native grapes, has not failed to produce abundant crops in twenty-six consecutive years; nor has fruit of any kind ever been known within these limits to be frost-killed, though there have been instances where it has been so from a severe freeze.

The Thermal Belt must exist in all countries that are traversed by high mountains and deep valleys, as the natural causes that produce it are as infallible as those which produce the rainbow in the clouds; and the only reason why its visible manifestations are peculiar to our southern Alleghanies is the fact that their precocious spring vegetation is sometimes killed by a frost, while the same thing does not happen in the mountains further north.

The philosophy of the subject, which I claim to have discovered and published the 28th of April, 1858, is the following:

Frost is but crystallized dew, and can only form during clear, still nights, when the atmosphere is in perfect repose. The atmosphere, when at rest, falls into a series of strata, one lying above the other, the heaviest stratum becoming the base of those above it, and all take positions according to their weight and density upon the principle of gravitation.

Heat is the agent that produces this result. This heat is of two kinds, both from the same source; the primary one being the sun's rays direct, and the other the heat reserved or retained by the earth. This heat is ever radiating, and in cold, clear, still nights it mounts upward through the cold, damp air, taking from it its caloric, while the latter rushes down in a cold frost, producing currents, and hence the lowest ground in a valley is ever subject to the hardest frosts. The warm, dry, light current keeps mounting upward like cork in water, until it reaches a stratum of atmosphere too thin and light to support it, when it consequently falls back and forms its warm, dry, genial stratum upon the top of the lower or frost stratum; and hence in cold, frosty nights is produced the phenomenon of the "Vernal Zone."

It is a fact that can be well attested, that all attempts to cultivate the grape in our low, damp valleys have utterly failed, the fruit being attacked before fully grown by what is called mildew-blight, while the few vines that grow upon the small

farms lying high upon the mountain sides have ever matured their fruit in the greatest perfection; and the true reason of this is, that all good varieties of grapes have thin skins, are of tender organization, and easily affected by a damp atmosphere and chill dew. And on the mountain, being within the comparatively dry thermal zone, they grow in an atmosphere peculiarly adapted to the delicacy of their tender organization. In view of these facts, I say confidently that any well-conducted effort at grape culture will succeed, whether it be upon the sunny slopes of our southern Alleghanies or upon the mountain sides that skirt the beautiful valleys of the northern States, and all that is required to insure success is to ascertain where this "Thermal Belt" is, and to plant the vines within its limits.

It is proper, however, to remark that this belt varies in the height of its range above different valleys according to the physical construction of the country. I will name a case in point. I made my observations in relation to this belt in Macon county, North Carolina, which is traversed by the beautiful valley of the Little Tennessee river, lying two thousand feet above tide-water. Here, when the thermometer is down to twenty-six degrees, the frost reaches three hundred feet vertical height. A small river, having its source in a high plateau nineteen hundred feet above this, runs down into this valley, breaking through three mountain barriers, and consequently making three short valleys, including the plateau, one rising above the other, each of which has its own vernal zone traversing the hill-sides that enclose them, the first of which takes a much lower range than that of the lower valley, and each taking a lower as the valleys mount higher in the atmosphere, and in the highest one the range of the belt is not more than one hundred feet above the common level of the plateau, a beautiful level height containing six thousand acres of land, and lying three thousand nine hundred feet above tide-water.

HOG CHOLERA.

BY EDWIN M. SNOW, M. D., PROVIDENCE, RHODE ISLAND.

THE disease to which the name of "Hog Cholera" has been generally but improperly applied has prevailed more extensively in this country than most persons are aware of. The first appearance of the disease, of which I have been able to find any notice, was in Indiana, in the summer of 1856. It has continued, to a greater or less extent, since that time in our western and southern States, in nearly all of which it has at some period attained the character of a wide-spread and fatal epidemic. Its victims in those States are numbered by hundreds of thousands, if not by millions.

During the last five years this disease has been seen, from time to time, in portions of the more eastern States, sometimes, as in western New York in 1856, proving quite severe and fatal in comparatively limited localities. But in the eastern States it has, to a great extent, originated with and has generally been confined to hogs imported from the west. I think that in no State east of Ohio has the disease prevailed extensively, or attained the character of a wide-spread epidemic.

In the vicinity of Providence, Rhode Island, it has prevailed to some extent, more particularly among large herds of swine, during each of the last five winters, but has been mostly confined to hogs brought from the west, and has

usually disappeared with the approach of warm weather. During the last winter it was more severe than in any preceding, and was not confined to western hogs. Neither did the disease, as heretofore, cease with the cold weather, but it continued until August, having destroyed more than five hundred hogs in Providence and in the adjoining towns during the first seven months of the present year, 1861. I have also heard of its prevalence in various towns in Massachusetts during the same period.

It is evident that a subject of so great importance to the agricultural interests of the community deserves attention. It is also interesting to all classes of the community on account of the relations of this disease to epidemic diseases which afflict the human race, and on account of its effects upon the supply of animal food for cities. For these reasons I have, in connexion with Dr. Collins and other physicians of this city, made some investigations upon the subject. We have visited and examined many sick hogs, and have examined the bodies of some of them after death. I have also made inquiries of those who have had the care of the hogs in relation to the symptoms, and have obtained information so far as possible from those who have seen the disease at the west, where it has prevailed so extensively. The results of these investigations I propose to give briefly in the following pages.

SYMPTOMS.

The symptoms, as described by persons unaccustomed to such observations, are extremely various. By combining the information obtained from others with the results of our own observations, the symptoms, as seen during the life of the animal, are nearly as follows:

1. *Refusal of food.*—This is the first symptom usually noticed by those who have the care of the animals, though, as will be seen hereafter, this symptom by no means indicates the beginning of the disease. The refusal of food, after it is first noticed, generally continues through the whole sickness, and food of every description is mostly refused.

2. *Great thirst.*—This is constant, and large quantities of cold water will be swallowed if it can be obtained. Even after the animal is unable to stand alone it will drink cold water with eagerness.

3. After a time, the length of which varies very much, the animal begins to show signs of weakness; reels, staggers, and, in attempting to walk, often falls down.

4. In most cases there is a diarrhœa, with copious fluid discharges of dark, bilious, and very offensive matters. In a few cases there is no diarrhœa, but evacuations of hard, black balls; but in some of these cases the fluid offensive matter is found in the intestines after death.

5. In a few cases there is vomiting; but this is not often severe, nor is it continuous for any length of time.

6. The external appearance of the animal is at first paler than usual; but towards the last of the sickness purple spots appear, first on the nose and sides of the head. These extend along the sides and belly, and between the hind legs, after which the animal soon dies.

7. In many cases, perhaps a majority, ulcers are found on the different parts of the body. These were particularly noticed on the inside of the lips and gums, and on the feet, and were often quite deep and excavated. In some cases these ulcers were seen in the nostrils, and in one case there were extensive ulcerations in the back part of the mouth, on the tonsils.

8. In some cases the legs are swelled, and the animal is lame; sometimes the ears and sides of the head are swelled and red; sometimes the eyes are sore and inflamed; sometimes swellings like carbuncles are seen; and, generally, the glands near the surface seem to be enlarged.

9. In most cases the pulse is quickened, the breathing is hurried and difficult, and there is much cough. But in some genuine cases there is no perceptible trouble with the lungs, and no important signs of disease are found in them after death.

10. The duration of the disease in fatal cases, after the first symptoms are noticed, is extremely variable. We have seen some which have died within two or three hours; others have lived many days. It is difficult, however, to fix the time of the appearance of the first symptoms. The first noticed is usually the refusal of food; but it is probable, indeed it is certain, that the sickness is in progress for a considerable period before the animal refuses food. Cases like the following are sometimes seen: A hog refuses to eat; it soon grows weak; staggers in walking; turns purple on the sides and belly, and dies within two or three hours after the first symptom is noticed. But, on examination after death, extensive disease is found in the intestines, or in the lungs, or in both, at a stage of development which must have required many days to reach.

Such are the symptoms as obtained from inquiries and observations in this vicinity. Since the preceding description was written, I have obtained a valuable article upon the disease, written by Dr. George Sutton, of Aurora, Dearborn county, Indiana, and published in the *North American Medico-Chirurgical Review*, for May, 1858.

Dr. Sutton made extensive and careful observations of the disease as it prevailed in Indiana, and his articles comprise the only published information I have been able to obtain in relation to it. His description of the symptoms is as follows:

"The hog at first appears weak, his head droops, and sometimes, in a few hours after these symptoms, diarrhœa commences. There is frequently vomiting. In some cases the discharges were serous and clay-colored, sometimes dark, also bloody and mucous, resembling those of dysentery. The urine at first was generally small in quantity and high-colored, but as the animal recovered it became abundant and clear; this was one of the symptoms by which the men, who were attending the hogs at the distillery, ascertained that they were recovering. *In a large number of cases the respiratory organs appeared to be principally affected*, and there was coughing, wheezing, and difficult respiration. In some instances the animal lost the power of squealing, and the larynx was diseased. There was frequently swelling of the tongue and bleeding from the nose. In those cases where the respiratory organs were the principal seat of the disease there was generally no diarrhœa or dysentery. In many instances the disease appeared to be principally confined to the skin; sometimes the nose, the ear, or the side of the head were very much inflamed; the ear swollen to twice its usual thickness. This inflammation would spread along the skin sometimes over the eye, producing complete blindness. Sometimes one or more legs were inflamed and swollen, and the inflammation also extended along the body. The skin, where it was inflamed, was red and swollen. Some had large sores on their flanks or sides from three to six inches in diameter. In one instance, at the distillery, the inflammation extended along the fore leg, the foot became ulcerated and sloughed off, and the animal recovered. Some appeared delirious, as if there was inflammation of the brain. Sudden changes in the weather, particularly from warm to cold, appeared to increase the fatality of the disease."

The symptoms, as described by Doctor Sutton, are similar to those observed in this vicinity, and the descriptions already given are sufficient to enable any one to recognize the disease wherever it prevails. It will be noticed that there is a very great variety in the symptoms described, and that they affect nearly every part of the animal. This would be expected from the nature of the disease itself, as will be seen hereafter.

POST MORTEM APPEARANCES.

Having described the symptoms, as seen while the animal is living, I will now give, briefly, the appearances found on examination of the bodies after death.

In the course of our investigations, during the last winter and spring, the bodies of nine hogs were carefully examined by Doctors G. L. Collins, J. W. C. Ely, and E. T. Caswell, of Providence, in the presence of several other physicians. A minute account of each case was prepared by Doctor Collins, and published in the *Transactions of the Rhode Island Medical Society*, for 1861. It will be sufficient for the objects of this paper to give a brief synopsis of the diseased appearances which were found in these examinations.

Lungs.—In two cases the lungs were healthy. In the remaining seven cases one or both lungs were more or less inflamed, having a liver-like appearance, called hepatization. In some cases the inflammation was more advanced, and the substance of the lungs was breaking down into a mass of disease. In all cases where the lungs were inflamed there was also pleurisy, and the lungs were adherent to the walls of the chest; the inflammation of the lungs and the pleurisy together constituting true *pleuro-pneumonia*. In two cases there were tubercles, or consumption in the lungs; but this is not uncommon in hogs, and is not supposed to have any connexion with the special disease we are considering.

Stomach.—The stomach and the small intestines were generally healthy. The stomach was frequently distended with an offensive mixture of food, and in one case the inner surface was ulcerated to some extent. In two cases worms were found in the small intestines; but this was probably a merely accidental occurrence, and had no necessary connexion with the disease.

Large intestines.—The inner coat of the large intestines was generally inflamed and softened with ulcerations to a greater or less extent, and they were frequently so tender as to be easily torn with the fingers. On account of their diseased condition their inner coat was frequently discolored. The inflammation and ulceration of these intestines are probably the principal cause of the diarrhœa in this disease.

Kidneys.—These organs were, in every case, much more pale and yellow than natural; this condition was well marked.

The *liver* and *bladder* were generally healthy. In some cases *water* was found in the cavity of the belly and of the chest, and in the membrane surrounding the heart, (heart-case.) In two cases numerous minute *purple spots* were seen upon the membrane lining the walls of the belly. The urine was often changed from the healthy condition, containing albumen and other diseased products, not, however, noticeable to the eye. *Ulcers* upon the feet and in the mouth were often found. The *brain* was not examined, as there were no symptoms observed which seemed to indicate disease of this organ. It may be, at times, affected, but is probably more rarely so than the other organs of the body.

Such are some of the most important appearances which are found on examination of the bodies of hogs which have died with this disease. It will be noticed that three of the diseased conditions I have described are prominent, important, and such as would be readily recognized by the most ignorant observer.

These are, first, the pleurisy and inflammation of the lungs; second, the inflammation, ulceration, and softening of the inner coat of the large intestines; and third, the pale and yellowish color of the kidneys. One or more of these diseased conditions will be found in every case, and in perhaps a majority of cases they will all be found in the same animal.

Doctor Sutton, of Indiana, in the article from which I have already quoted, gives an interesting account of the *post mortem* appearances in hogs dying from this disease. He examined the bodies of sixty-seven hogs, and it is evident from his article that he had the opportunity of observing the disease in a more malignant form than it has presented in this vicinity. He mentions every diseased condition that I have described, and also found unmistakable marks of similar disease in almost every other organ of the body.

With the description already given of symptoms and post mortem appearances, most persons, even without medical knowledge, will be able to recognize the disease. It remains for us to consider, briefly, its nature, causes, prevention, and treatment.

NATURE OF THE DISEASE.

The first question which arises in the minds of most persons is this: *What is the disease?* and the question is asked with a special desire to have it answered by a definite name. This cannot be done; there is no name which would convey, even to physicians, and certainly not to others, a precise idea of the disease. But though there is no specific name by which it can be called, the facts, as already given, cannot fail to suggest, at least to medical men, a correct idea of its nature.

Sometimes in the human subject, particularly when portions of the body are undergoing the process of inflammation and suppuration, pus and other diseased products are absorbed, and entering into the circulation, poison the blood and produce that condition of the system known as pyæmia. In such cases the general poisoning of the system is shown by a low form of fever, great weakness and prostration of the vital powers, frequently accompanied by vomiting and purging, and often resulting in pleurisy, with inflammation and deposits of matter in the substance of the lungs, superficial swellings and abscesses, inflammation and suppuration in the joints, and other diseased phenomena. So in severe forms of typhus or ship fever, and in malignant cases of some other diseases, when the whole system seems to be filled with a powerful poison and utterly prostrated, the same or similar effects are seen. So in this disease among hogs there seems to be a general poisoning of the blood, producing local inflammations and ulcerations in various parts of the system, though more frequently in some portions than in others.

This, then, is a general disease of the whole system, resulting from some poisoning of the blood; and the pleurisy, the inflammation of the lungs, the ulceration of the intestines, the superficial ulcers and swellings, and other effects I have described, are only the local effects or results of the general disease.

The diarrhœa, which exists in a majority of cases, and on account of which the name of "Hog Cholera" has been given to the disease, is probably caused by the local inflammation and ulceration of the large intestines. The name "Hog Cholera" is, therefore, entirely improper, as it represents only one of the several prominent symptoms. The disease might as correctly and as incorrectly be called a "pleuro-pneumonia."

In this connexion, it is proper to notice the similarity which exists between this disease in swine and some epidemic diseases which have prevailed among cattle. Some two thousand years since a disease, to which the name of "murrain" was given, was described by Virgil as "a highly inflammatory fever among cattle, accompanied with tumors, carbuncles, ulcers, and purulent deposits throughout the whole body." Any one who reads this and other descriptions of murrain, as given in the *New American Cyclopedia*, cannot fail to notice the striking similarity between that disease among cattle and the disease among swine, which we are now considering.

The same is true of the disease which has caused so much excitement in

New England, within the last two years, under the name of "pleuro-pneumonia." Its symptoms and post mortem appearances, so far as described in the reports I have seen upon the subject, are very similar to those observed in the disease among hogs which we have examined. The only case of the disease called "pleuro-pneumonia" that I have seen was in the vicinity of Providence, in July, 1861. In that case, in which a post mortem examination was made by Dr. Collins, it was the unanimous opinion of the physicians present that there was a remarkable similarity in the symptoms and appearances to those observed in the hogs examined previously.

The conclusion to which I have arrived is, that the "hog cholera" I have described, the "murrain" of Virgil and of all ages since, and the "pleuro-pneumonia" of New England, are similar diseases, having the same general features, producing similar diseased changes in the body, and are the result of similar causes. If a definite name is required, the name of "murrain," which is derived from a Greek word which means to *waste* or to *weaken*, is the best. The names "hog cholera" and "pleuro-pneumonia" are both improper, and give erroneous ideas in relation to the disease.

CAUSES.

In this and other similar diseases among animals, as well as in epidemic diseases in the human race, the universal tendency of the public mind is to ascribe their propagation to *contagion*. Dr. Sutton, whom I have already quoted, says: "Although this disease must occasionally have a spontaneous origin, yet, when once produced, it will spread rapidly by contagion."

The investigations of the cattle disease in Massachusetts in 1860, and the action of the legislature in regard to it, seem to have been based upon the theory that the disease was a "pleuro-pneumonia" only, and that it was contagious.

It is comparatively but a few years since the belief was universal that yellow fever and cholera were contagious, and the most oppressive and inhuman quarantine restrictions, based upon this belief, were enforced to prevent these diseases in every port of the civilized world. But the enlightened opinion of the medical profession and of sanitarians of the present day has formally decided that yellow fever is not contagious; while the idea that cholera is contagious is abandoned, so far as I know, by all intelligent physicians at the present time.

So I firmly believe it will soon be with reference to this and other similar diseases among animals. They are not contagious, and the belief that they are so is productive of great injury in the adoption of measures for their prevention. But this disease among swine is an epizoötic disease, or perhaps we shall be better understood by saying that it is an epidemic disease among animals.*

If, then, this be an epidemic or epizoötic disease, its causes are similar in their nature and operation to those of other epidemics. The following, then, as I understand the subject, *are the causes* not only of this disease among swine, but also of the disease referred to among cattle, as well as of epidemics in the human race, viz:

1. *An epidemic atmospherical poison.*

2. *The local conditions or circumstances adapted to receive and propagate the poison existing in the atmosphere.*

With regard to the first cause, the atmospherical poison, very little is certainly known. It may be an animal or vegetable existence, or a chemical or electrical change in the atmosphere. Nor do we know anything of the differences in the condition of the atmosphere by which such dissimilar epidemic and epizoötic

* The phrase "epidemic disease among animals" is incorrect, as the word "epidemic" can properly be applied only to diseases of the human race. The word "epizoötic" has the same meaning with reference to diseases among animals that the word "epidemic" has with reference to diseases among men.

diseases are produced at different times. But, judging from their effects, we conclude that these primary causes of epidemics probably exist in the atmosphere; that they progress over a greater or less extent of country, in accordance with laws with which we are not acquainted, and alighting upon the earth produce their effects wherever they find the local conditions adapted to their propagation.

The local conditions, or causes of this disease among swine, are more obvious and much better understood. They are, briefly, impure air arising from the filth with which the animals are surrounded, the location and want of ventilation of the pens in which they are kept, the use of improper and unhealthy food, and the want of pure water. Common sense shows that cleanliness, good food, pure air, and pure water are as important to prevent disease in hogs as in men, though the fact is generally ignored by those who have the care of these animals. Another condition, though not absolutely essential to produce the disease, has a very great influence in increasing its severity and fatality. It is the crowding of large numbers of animals together. It is a well-established fact that the severity and fatality of cholera, and of other epidemics in the human family, is in direct proportion to the density of the population.

The coexistence of both the causes given, viz: the atmospherical poison and the local conditions, is necessary for the extensive development of the disease. When both these causes are present in any locality, and healthy animals are brought into the locality, a portion of them, and sometimes all, will contract the disease. But this important fact is to be remembered, that both these causes may exist in a locality whether any animals are present or not.

Perhaps I have said more than some might think necessary in relation to the causes of the disease; but the subject is of the utmost importance in its relations to preventive measures. If this and other similar diseases are not contagious, but arise from causes which may, and do, originate and exist wholly independent of the presence of animals, it is manifestly absurd to attempt, as has been done in some cases, to prevent and eradicate them by the wholesale destruction of the animals.

PREVENTION.

Keeping in mind the causes of the disease as I have given them, the measures necessary for prevention are obvious, and may be stated in a very few words. They are, to remove as far as possible the causes. The general cause existing in the atmosphere cannot be removed, nor can it be avoided, except by the removal of the animals beyond the limits of its existence, and this is not usually practicable. But the local causes can, to a very great extent, be removed, and without these the general cause cannot produce any very serious results.

The hogs can be removed from their filthy pens and can be kept clean; they can be removed from low ground to more elevated places; they can be separated and isolated as far as possible; they can be allowed an abundance of pure air and of pure cold water; and they can be supplied with nourishing, healthy food. In a word, they can be placed in the conditions which common sense shows to be essential to health, whether of hogs or of other animals. When this is done, everything is done that is necessary or possible for the prevention of this as well as of other similar diseases.

TREATMENT.

In the treatment of a disease of this character we have little to expect from the specific or direct action of medicine of any kind. The most that we can hope to do is to support the system so as to enable nature to overcome the disease.

In a human being, with a disease of a similar character, we should first remove the patient to a healthy locality, and provide for an ample supply of pure

air and good nursing. This, faithfully done, would be the most important step towards recovery. We should then give, as the symptoms might require, beef tea or broths, milk, wine-whey, brandy, quinine, and other similar preparations; always remembering that the object is to sustain the animal powers so as to enable the system to withstand the depressing effects of the poison and free itself from its presence.

The treatment of hogs with this disease must be of a similar character. Stimulants and tonics of some description, with plenty of pure air, pure water, and suitable nourishment must be given. Chlorate of potash, in full doses, from its known effects on the human subject, has been proposed as a remedy, but of its value I am unable to speak. Powdered charcoal is undoubtedly of some value when scattered freely about the pens and given to some extent in the food.

But, in the severer cases, treatment of any kind is generally unsuccessful, and if successful would cost more than the animal is worth. We might succeed, by the use of the remedies named, and by careful nursing, in prolonging the life of the diseased hog; but success of this kind would hardly compensate the trouble and expense necessary to secure it.

But a large number of the milder cases will recover without treatment of any kind, and in this, as in other epidemics of a similar nature, it will be found that the first cases that occur will be very severe, and will nearly all prove fatal; while after the epidemic has existed for a time, the disease will seem to become more mild, and a much larger proportion will recover.

The important fact to be remembered is, that it is for the interest of the owner of these animals to use every possible means *to prevent the disease, as prevention is of infinitely more importance to him than treatment;* but if the disease becomes established, it should be treated in a rational manner, not forgetting that Nature, when properly aided, will do infinitely more than medicine for the cure.

TERRITORY OF COLORADO:

ITS SOIL—ITS CLIMATE—ITS MINERAL PRODUCTS AND RESOURCES.

BY EDWARD BLISS.

The act of organization of the Territory of Colorado describes its boundaries as follows: "Commencing on the thirty-seventh parallel of north latitude where the twenty-fifth meridian of longitude west from Washington crosses the same; thence north on said meridian to the forty-first parallel of north latitude; thence along said parallel west to the thirty-second meridian of longitude west from Washington; thence south on said meridian to the northern line of New Mexico; thence along the thirty-seventh parallel of north latitude to the place of beginning."

THE GREAT AMERICAN DESERT.

An examination of the map, and a careful tracing of the limits above described, will convey some general idea of the topography of Colorado Territory. The Rocky Mountain range—the great backbone of the North American continent—runs through the Territory from north to south, dividing the vast plains of the

eastern slope from the extensive parks and savannas which stretch away towards the Sierra Nevada. The eastern portions of Colorado embrace that mythical region laid down on all the old maps as the "Great American Desert." It is almost needless to add that the discovery and development of the mineral resources of the Rocky Mountain region has furnished the evidence of over one hundred thousand witnesses against the existence of the "Desert." The commerce of the plains, involving the necessity for the employment of immense herds of beasts of burden, has effectually dissipated the fabulous belief that a vast desert existed in the basin east of the mountains, where nothing to sustain animal life could be obtained. The writer of this has often seen herds of several hundred cattle feeding in various portions of the "Desert" district. On all the watercourses, and especially in bottom lands, the grasses thrive most luxuriantly. It is, nevertheless, true that on some of the uplands there is a tendency to barrenness, caused not only by the aridity of the climate, but by extended strata of sand. Yet even upon these wastes there are frequent patches of thrifty vegetation, while the cactus covers the earth with its brilliant and beautiful rosettes of flowers.

THE PASTORAL REGION.

Nearer the base of the Rocky range, and along the valleys of the streams which have their origin in the mountains, vegetation is more prolific and the soil more arable. The grasses here are not only abundant, but grow to immense size, and contain more nutriment than the cultivated species of the most prosperous agricultural districts of the Mississippi valley. These grasses cure standing, and cattle feed and thrive upon them throughout the entire winter months. As a great grazing and stock-raising region, Colorado possesses advantages over Texas. The latter is subject not only to terrible storms, but long-continued rains, which to unsheltered stock are so fatal; while in Colorado no bleaching rains, no tornadoes, destroy the standing grasses or waste their nutriment. It is rarely that unworked cattle in Colorado require winter fodder. For three winters past there has not been twenty days in each that loose stock required feeding, and it is a remarkable fact that they will not eat cured hay so long as they can have access to ungrazed pasture lands. Beef cattle are driven in the months of January and February direct from the fields to the shambles, and nowhere in the world can finer or more tender beef be found than in the markets of Denver.

AGRICULTURAL RESOURCES OF COLORADO.

These facts furnish incontestable proof that the soil of that region is highly productive. But a serious apprehension exists in the minds of many that the capabilities of the country for extended agricultural purposes are limited. This opinion is based upon the fact that rains throughout that entire region are unfrequent, and occur at seasons when their grateful influences are not beneficial. Candor compels the admission that there is some truth in this statement. Throughout nine months of the year—from October to July—not an inch of rain falls; and even in July and August, when showers are common, they are of such short duration that the parched earth is seldom satisfied. The observation and experience of three years has demonstrated that the cereal grains cannot be extensively and profitably cultivated in Colorado by the same system generally followed in the grain-growing districts of the States. Ploughing, sowing and harvesting, even though prosecuted with the same skill, will never produce the satisfactory results which reward similar efforts in the western States. Nature withholds her rains from the plains of Colorado, and admonishes her people that they must strive to overcome this deficiency by artificial appliances.

IRRIGATION.

Thanks to the record of history, to the necessity and experience of various portions of the world, and to the actual successful efforts of the people of Colorado, they are not to be deprived of the inestimable blessings which flow from agricultural enterprise. Throughout the entire length of the mountain range the rocky barrier is rent with cañons, through whose beds copious volumes of pure water rush forth into the valleys beneath, and stretch their limped arms far out into the plains. The sturdy farmer has but to check the dashing torrent in its course, and divert a portion of its grateful element, through artificial channels, across his thirsty and arid fields. A combination of interests, and a general and well-directed system of *irrigation*, will soon relieve the Territory of Colorado from the difficulties which now limit agricultural labors. Indeed, the results of numerous irrigating enterprises during the past season, for gardening purposes solely, were not only most gratifying, but immensely profitable. It was ascertained that in the wide bottom lands of the Platte river, and other streams near the base of the mountains, there was a rich alluvial deposit which only required water at long intervals to promote an astonishing vegetable growth. All the succulent varieties of plants attained to an enormous size, retaining the tenderness, juiciness, and sweetness which almost everywhere else belong only to the smaller varieties. The wild fruits of Colorado are also various and abundant. Of these, cherries and currants are most numerous, while raspberries, grapes, and plums are in some sections quite plenty.

THE CLIMATE.

The climate of Colorado, especially that portion lying at the base and east of the mountains, is not only most delightful, but remarkably healthy. The frosts come early in the autumn and continue far into the spring months, but they are not severe. Throughout the winter months the sun blazes down with almost a tropical glow; little or no snow falls, and although the nights are sometimes sharp and frosty, there is no steady intensity of cold. In the mountains there is, of course, a lower temperature. The nights are much colder; there is more snow, and the rigors of winter are not only protracted, but severe. But this is the characteristic of all high mountain regions; and as the residents of the sierra in Colorado can, by riding from six to ten hours, reach the genial atmosphere of the valley, they are never "winter-bound." Some idea of the climate may be gathered from the following extract from the "*Rocky Mountain News*," published at Denver. The article from which the extract is made appeared in the *News* of the 21st of *December:* "The office in which we write has not had a fire in it, nor the need of one, this winter." These facts ought certainly to establish the claim of Colorado to mildness and salubrity of climate. The record of mortality, as seen by reference to the obituary heads of the newspapers of the Territory, affords gratifying evidence of the healthiness of that region. When it is remembered that the principal occupation of the inhabitants—mining—involves the most tedious, laborious effort, great exposure, and oftentimes imminent danger, and that many are there who have never before experienced the hardships and privations incidental to frontier life, the sanitary condition of Colorado is truly remarkable.

MINERAL PRODUCTS, IMPROVEMENTS, ETC.

The Rocky Mountain ranges are evidently of Plutonic origin, and consequently abound in rich and valuable minerals. Gold, silver, iron, copper, lead, and coal, have been discovered, and a variety of sulphurets, carbonates and oxyds. The principal resource of Colorado Territory thus far has been its

auriferous product. Public attention was first attracted in this direction in the fall of 1858, at which time good "prospects" were found on Cherry creek, near its confluence with the Platte. Since then prospecting and exploration has rapidly developed the existence of gold throughout a wide extent of territory along the mountain ranges, and encouraged the investment of a large amount of capital. It is estimated that there are not less than two hundred quartz mills and rastras already erected in different portions of the Colorado gold region, involving in their transportation and fitting up not less than one million of dollars. In addition to the cost of this machinery, vast sums of money have been expended in opening and working quartz veins, in river and bar mining, and in various other enterprises indispensably attendant upon mining operations. Fine coach roads have been constructed over and through the mountain ranges, where three years ago the most sure-footed animal could not have safely ventured. Ditches of many miles in length now convey water around mountain sides and across deep valleys for the use of miners, and away up under the very shadows of the Snowy range are busy towns teeming with all the life and enterprise which characterize thrift and progress in the old settlements of New England. Night and day, and in all seasons, may be heard the clanking of heavy stamps, the shrill scream of the steam whistle, the roar of exploding blasts away down in the bowels of the earth, and the rush of waters over ponderous wheels, and yet scarce three years have passed since the solitude of that region was only broken by the scream of the panther, the howling of the wolf, and occasional death struggles between hostile savage tribes.

The results of mining operations in the Colorado gold region during the past year are encouraging. It is estimated that the gold product will not fall much short of four millions of dollars, and it is confidently believed that the current year will close with an exhibit of three times that amount as the yield of 1862. Time which has heretofore been expended in erecting machinery, opening claims, and *preparing* for business, will this year be devoted to actual gold mining efforts. The experiments of the past will give place to the successes of the future, and even those who have toiled long and gained nothing may, with some degree of confidence, look forward to a more prosperous period.

AGRICULTURE OF SAN BERNARDINO COUNTY, CAL.

BY LIONEL M. JACOBS.

A REFERENCE to the map of the State of California will show to the observer the existence in its most southwestern portion a large division, in which is comprised the county of San Bernardino. Within the limits of a brief article, the object of which will appear from the variety of its subjects, the writer will endeavor to give some publicity to facts which are of interest, and may be of information to the reader.

EXTENT AND CLIMATE OF THE COUNTY.

The extreme eastern boundary of the State is also that of this county, from which it extends back to Los Angeles county on the west, and is bounded by San Diego county on the south. Embraced within latitude 33° N. to 35° N., and longitude 114° W. and 117° W., a range of country is presented containing every variety of climate. The mountains of the Coast range extend through a

part of the county, and the highest peak in the range in southern California. Mount San Bernardino, whose altitude is generally conceded to be over five thousand feet above the level of the sea, is the mountain in the valley at whose base the chief town and county seat is built, and from which the county takes its name.

The climate of the county, in common with that of the section of the State lying below the 35th parallel, is eminently salubrious, and conducive in every degree to the interests of agriculturists. The thermometer ranges in May, June, and July, from 80° to 95°, while in the winter (?) months, by which the few rainy months are designated, the cold in the valleys rarely exceeds 50° Fahrenheit. In the mountains, of course, the reverse is the case, the altitude of the situation rendering any other case contrary to every evidence of nature. There winter in reality sets in about November, at which time the snows fall, which continue until about February, when the inclemency of the cold months gives way to the gentleness of approaching spring. From February on to August the weather ranges from coolness to a pleasant warmth, which in September is succeeded by the same degree of coolness which prevails in the early part of the year. In the valleys—excepting those which are situated on eminences above that of San Bernardino valley, which in this sketch is taken as the point of observation and remark—nothing can exceed the beauty of the climate from February on to November, at which time even sunny days are attendant upon clear, blue, cloudless skies and cool, pleasant nights. During the months of July and August the heat sometimes becomes intense, and the degrees of 100, 101, 102, 103, and at times as high as 110° are attained. This extremity is, however, rarely reached, and when during the "heated term" of the summer months the point is gained, the reason is to be ascribed not alone to the intensity with which the sun's rays are showered down, but also to the want of those cool breezes which a closer proximity to the sea-shore—San Bernardino city is distant eighty miles from the nearest point to the sea—and to the fact that the winds of the great deserts are wafted to us after passing over their burning sands.

Rains fall during what is known as the "rainy season" only, which generally commences at about the first or middle of November, and continue on till the beginning of February. During the intervening time but very little, if any, rain falls, although, as in the case of the past year, (1861,) the first rain of the season fell about the 25th day of September. Showers, slight sprinklings, occur during July or August; their occurrence, however, is so rare that the "oldest inhabitant" can cite but few instances during the course of his lengthened experience in which they have occurred.

SOIL.

Within the entire limits of the county every variety of soil is found—clay, marl, sand, loam, calcareous, and rocky. There is also soil impregnated with alkali, which in some few localities is a source of annoyance to the farmer, but which thorough working and the carrying out of the proper means for its eradication remove in the course of a short time. The low alluvial land of the bottoms is used in seasons when drought of any nature prevails, while the high lands, extreme cases, are cultivated when the rainy season affords copious means of thoroughly impregnating the soil with the dampness which they otherwise lack, and which is necessary to insure the return of the crop. These high lands, known in contradistinction to lower lands as benches, possess every requisite for cultivation but that of water, which, were it extant, would afford an infinite amount of land for cultivation that, now being idle, could be made a source of benefit to the worker. The character of soil mostly used is the medium between the two extremes here cited, the bottom land and the high bench land, as is selected with a view of its adaptability to irrigation when a sufficiency of rain

should fail to fall, or if other causes should render such a course necessary. The alkali lands are those which require the greatest care, and in the hands of the unacquainted a source of great annoyance and loss. The treatment recommended generally is a thorough working of the soil with alternation of crops, which, when properly followed, generally effects the desired end. Although cited as among the classes of soil, the "rocky" does not exist in any places as yet placed under cultivation, and requires consequently no further comment.

CAPABILITIES FOR PRODUCTION AND PRODUCTS.

It follows, as a matter of natural consequence, that where these characteristics are found, where this diversity of climate exists, and where the varied classes of soils are presented, that the field for production is wide, and that what is produced should be as diversified in class as the means and circumstances which produce and surround them. This is fully carried out in the view we have of the tropical fig and orange being cultivated where but a distance intervenes between them and the apple, the pear, and the peach of the more temperate zone. The lofty mountain tops are covered with forests of the lordly pine, while in the valley we see the majestic palm's drooping branches gracefully sway with the summer's breeze. The opposite spectacle here presented finds but few parallels, and this contrast is more fully carried out when, after the yearly rains set in, the mountains are topped with glistening snow, while the vales, verdant with the grass which immediately springs responsive to Nature's call, wear the air of perfection which such a "carpet" adds to the landscape. The crops chiefly produced, and which will be commented on in the order in which they are here named, are the following: wheat, barley, corn, beans, oats, rye, tobacco, sorghum (sugar) cane. Fruits ranging through the entire catalogue are also cultivated, which will be severally reviewed. Grapes, of course, abound, and are very successful wherever cultivated.

Prior to remarking on the various crops, a few words on various processes of agriculture and their use and abuse as here practiced may not be out of place. Although spontaneous production almost exists, the same care which less productive soils require is not thrown away, as the attentive agriculturist will have discovered. The chief of these is irrigation, which will be first discussed, as its importance requires it. Others will be remarked on in continuation.

IRRIGATION.

As stated under the proper head, rains discontinue after February. From this time on until harvest, the heat increasing and no rain falling, crops become affected by drought were not means taken to prevent such a result. The copious supply of water which the abundant streams contained in the county afford is brought into requisition in this strait. The proper appreciation of the due requirements of the land to be irrigated is not always entertained, and in many cases irrigation is overdone. The necessity for that means of bringing crops to maturity is, however, very evident, as personal observation would convince, and the use thereof attest.

MANURING

Is practiced very slightly, and only then in extreme cases. The soil being rich, the essentials not having been extracted by the few years of cultivation which it has undergone, the necessity does not exist for adding any additional nourishment to that which is already sufficiently nutritious. In one instance an attempt was made to manure a field of corn which had been made to bear a crop of the same class successively for five years, the idea being that doubtless a necessity existed for that action. The result was anything but satisfactory, the

effect being the same as in all instances where the land is over-manured, and evidenced that the opinion of the richness of the soil was underrated. In working new mucky soils, some manuring has been found beneficial. The quantity must, however, be small and very equally applied, and then only after first well working the land.

DRAINING.

The bottom lands, which are sometimes too wet, although requiring drainage, have never yet undergone the process. Corn is generally planted, and, as no irrigation is needed, produces well. Besides which, land is so abundant that the farmer can take his choice, and, of course, usually takes that requiring the least labor. Apart from this reason is the fact that land is cheap, labor valuable, and time here really is money. The expense of draining a piece of land of any given size can be applied far more profitably in other ways. The proper material for thorough draining is difficult to procure, and considered as it may be, the process presents difficulties at every step, which are well understood by those to whom the experiences of life in a new country are familiar. Many advantages would ensue from the process were it carried on, while no doubt can prevail of the necessity there exists for its being put into operation. The requirements, however, of the soil are not taken into consideration in this particular, however, and cultivators pursue the even tenor of their way, regardless of any benefits which a proper course would insure to them. One single instance has, however, come under my observation of land being drained and then thoroughly manured with every success. The character of the soil was the very swampy bottom-land before referred to, which happened to be in the way of the proprietor, who, not being able to make use of it in any other way, was compelled to give it the treatment described. This instances how satisfactory would be the result were the same course more generally followed.

WHEAT.

Immediately upon the first winter rains falling the soil is prepared for ploughing, unless the season should have commenced early in October, as happened during this year, (1861,) when ploughing is deferred for two or three weeks. Should the rains that have fallen not have been sufficient for planting purposes when ploughing is undertaken, irrigation is resorted to, and the land flooded. The crop generally succeeds well, its only danger being the rust, which the fogs, prevalent at the critical time, are apt to produce. Many have tried very early sowing in hopes to avert the calamity, while others resort to late sowing, in order to have the crop in that stage when fogs do come that it will not be liable to the danger. Strange to say neither of these means produce the desired effect, for we find that fields of both early and late sowing are alike visited by the scourge. Again, in fields sown with seed of apparently exact character, strips become rusted, while others are left unharmed. The most favored locations seem to suffer at times equally with others less choice, and all resort to the one common remedy of soaking the seed for twenty-four hours prior to sowing in a solution of blue stone, (sulphate of copper,) which, it is alleged, acts in some degree as a preventative to the crop being attacked. The grain produced is not of the very best character, from the want of attention in procuring good seed and the neglect of those who cultivate annually to exchange choice varieties with those who have them. One of our farmers here, when his crop is ripe, proceeds through his field, and with a knife cuts the heads containing the plumpest grain, which he preserves for the following year's sowing. He has also practiced sowing in drills (the majority do it broadcast) and met with but little success in his endeavor. A gentleman who procured good seed wheat succeeded in distributing it to his immediate neighbors at favorable rates and with good return. The

crops average, I should judge, from thirty (30) to thirty-five (35) bushels per acre when a moderate crop is harvested, and from thirty-five to forty when a good and full crop is secured. Irrigation is practiced in the treatment of the crop, and the effect is so different on the various characters of soil that it would be difficult to say whether its results are detrimental or beneficial. The native California population are great devotees of irrigation, and consequently put their belief into practice; they succeed in bringing good grain to market, equal almost in quality to that raised by Americans.

It is difficult to classify the varieties of seed wheat sown here. The original seed, by sowing and resowing, has become so deteriorated that but little of the original excellence remains. It is supposed, however, that what is known as Australian wheat is mostly sown, while the varieties of Chili and Sonoranian are also chosen. In this regard the kind offices of the agricultural division of the Patent Office are solicited, for good wheat seed was never more urgently needed than by the agriculturists of this country.

BARLEY.

This crop is given attention to equal with that of wheat, to which, however, it is placed subordinate, from the fact that the former possesses more importance and value than the latter. In this State, however, from the cause that it is the chief feed, its cultivation is a prime matter, and the quantity sown exceeds that of all other crops, except wheat. Barley succeeds well here, and is preferred on the account of its not being liable to any of the chances of failure which other crops are harassed with. Sowing is commenced about the same time, or say slightly after that of wheat, in the productiveness of which it excels. Forty-five bushels per acre is the maximum average crop, while, in some few cases, as high as sixty bushels per acre have been said to have been harvested.

CORN.

The attention of cultivators is paid to the cultivation of Indian corn, which the abundant bottom lands of the county are so well fitted for the production of. Planting commences as early as April, or sooner, if the warm weather has definitely been established to have set in. Planting is generally done in rows six feet apart, the hills being three feet from each other. During the past year, rains having fallen heavily, many planted when the few days of warm weather gave them reason to suppose that it would continue so. A few days succeeded which were rather damp, causing the seed to rot. Upon the second planting a worm (the cut-worm, I presume, but) called here the "wire-worm," attacked the roots of the corn after appearing some inches in height above the ground. Re-planting was again made necessary. Some thinking, from the incipiency of the planting, what the consequence would be were the worm to attack their crop, took the precautionary measure of planting in hills *eight inches* apart, which gave room for a plentiful planting, even if the worm did do considerable damage. As the season advanced, and the crop grew, the intervening hills that remained were cut out, and the remainder thrived. Corn always produces plentifully here, though the complaint is, as in the case of wheat, that the quality is none of the choicest. Nevertheless, the product is fair.

BEANS.

The classes of red and white beans planted here are not numerous. The native red bean (frijol Colorado) is most extensively cultivated, and is planted as late as the end of May, and as early as the beginning of April. It is planted generally in hills three feet each way, and requires considerable irrigation, which is awarded to it.

OATS.

Unlike the prominence which in the eastern States is awarded to this grain, it finds in our State a subordinate position. Barley takes its place from the greater facility of its cultivation, and its fuller yield. Oats are, however, capable, were the effort made, of being brought to the same standard as they occupy elsewhere. As matters are, however, the crop is a secondary one, but slight attention being given to it. Such trials as have been made prove it to be worthy of cultivation were the demand (which now does exist) to arise for it when produced.

RYE

Is also cultivated somewhat in a similar spirit to that to which the preceding remarks apply. As well as with oats, the mode of cultivation is the same as practiced in the eastern States.

TOBACCO.

Endeavoring to make their land profitable and at the same time procure some remuneration for their labor, a few individuals went into the raising of tobacco. The land was prepared, the seed procured and planted, and the crop produced. The result was very satisfactory, the leaf being equal in size and appearance to that raised in Virginia and Kentucky. The difficulty, after having the crop, was found in the inability to properly cure it, which several attempts shewed they were unable to duly effect. The experiment demonstrated what was at first merely supposed, that the cultivation of tobacco could be successfully carried on here. The attempt will be renewed here again, and as efforts will be made to procure the proper ability in the "curing," it is not unlikely but what the raising of tobacco will become a matter of prime importance to our county. In our neighboring county of Los Angeles the experiment resulted similarly. I have not, however, heard of its repetition, or of any intention to do so.

SORGHUM, OR CHINESE SUGAR CANE.

This should have preceded the remarks on tobacco, as, while that has been merely experimented on and hardly worthy to be called a perfect success, the sugar cane has invariably proven in the highest degree satisfactory. Although comparatively little has been done with it commensurate with its accorded importance, enough has been shown to evidence its being worthy of more general attention. From an acre planted in this vicinity, it appears that the result was over one hundred and twenty gallons of sirup. The cane was first cut with knives, (machetas,) and ground in a rude mill made by placing two wooden rollers perpendicularly in a frame, from which an egress was made for the juice, which fell into a receiving tub placed there for that purpose. The rollers were worked by a connecting pole and the motive power a horse. The juice of the cane was immediately boiled in a sheet-iron boiler fastened in a furnace, and produced the sirup. The article yielded was very good, although more complete machinery and greater attention in the boiling of the juice might have produced a more superior article. The sirup seems to be well liked and sells readily. An idea is entertained here, however, that, as so much difficulty is experienced in making sugar, that the name of *sugar* cane is a misnomer. The attempts that have so far been made have all failed to bring about any granulation. I am only informed that such is the case, and am not aware what process was made use of, nor whether the strict requirements of the case were complied with. I do not, however, venture much in asserting that no very scientific means were

availed of, else some result would most undoubtedly have been secured. Should it ever be discovered that sugar can be made, a universal resort to its cultivation would immediately be made. As at present pursued, the cultivation of the cane is so carried on that irrigation of it is necessary at least every three weeks after the cane has attained the height of about twelve inches. Although planted in rows and properly hilled, its properties for spreading are such that what, at first, appears as a regularly planted field soon assumes an irregular look, and towards the end of the season almost entirely covers the ground on which it is planted. In the case cited, passage was impossible, so thickly had the cane become. The result of the attempts, even so far made, has been productive of the result of inducing a great number to engage in its cultivation, thus presenting more extended means of noticing the matter in the greater variety of examples which will then be presented.

The remarks which have already been made in the course of this article have been sufficient to have conveyed the fact that, although the means exist in every particular, the attention is wanting to *fully* avail of them. If this is the case in the most essential particulars of the varied chief crops, it cannot but exist similarly in the more diverging branches of the science of agriculture. Thus, though we find all productions to exist, the due development is wanting. This we will find to be the case in reviewing our fruits, the most extensively cultivated of which is the

PEACH.

All through the entire "length and breadth" of the county every farm and homestead has its orchard, and the peaches predominate largely. The difficulty which exist in less favored localities of their production does not exist here; and, as an instance of how they do grow, it can be said here that sprouts have grown in a season to the height of *ten* feet. The majority of the trees are seedlings, without grafts or buds. Budding is, however, pursued, and as fine varieties of the fruit produced as can be seen even in New Jersey. The favorite varieties are the early Tillotson, the early York, the Oldmixon Cling, and the Strawberry, the latter being the choicest.

OTHER FRUITS.

Apples do not succeed very well universally. The red Astrachan is the favorite variety, and in common with the Pippin receives the most attention.

Pears are very successful. The qualities raised are not various, and the Bartlet justly leads the few varieties that are produced, among which the Julienne may also be named.

Apricots and Figs of native varieties are produced, but none of any varieties having repute. The fruit produced is, however, of a superior kind.

Plums are very productive, and those that are most prominent are the Green Gage, the Damson, and the Jefferson. The fruit is large, luscious, and well appearing, and is worthy of more particular attention than is bestowed upon it.

While other fruit may not have proper justice done to it, from the causes which have been noticed, circumstances are such that on all sides the deepest attention, and justly so, has been awarded to the production of

THE GRAPE.

In the entire southern part of California the grape succeeds admirably. Cuttings two and a half to three feet long are placed in holes made for the purpose with a crowbar, to the depth of eighteen inches, the land having been previously well ploughed. For the first few months after being set, and until the fact that they have taken root becomes fully demonstrated, they require constant irrigation. The cuttings are placed six feet apart in rows from east to west, the rows

being six feet from each other. The vines are pruned in January and February, at which time the cuttings are set out. During the second year, and until the third, when they invariably commence to bear, but slight irrigation is found necessary. After the vine bears irrigation is practiced only four times during the season: when the vine commences to leave out, when it blossoms, when the grape begins to enlarge, and lastly, when they begin to color. The varieties cultivated are all native and of the black character. No Muscatel grapes are cultivated in the county that I am aware of.

HORSES.

The horses of this county are most entirely those of the native breeds. The country was, on its acquisition by the Americans, found to be almost overrun with the numerous bands of horses then to be seen on all sides, which settlements have now, in a measure, reduced. The California horse is small, active, and enduring. A journey of sixty miles a day is a common occurrence for animals whom, to judge from appearances, half that distance, if accomplished within sunrise and sunset, would be difficult of accomplishment. The California horse excels the generality of what we know here as the American horse, in the particular that he excels the latter in being enabled to perform a greater amount of work in a certain time with less subsistence; only, however, in the saddle, which is the most natural way for him to be used. The habit of a century has had its effect upon the breed, for we find that their excellence prevails in the particular use alone in which they have become accustomed. It follows, then, and is the case that, as draught horses, they are inferior to the American horse, the latter's superior size and build making them more suitable to that kind of work; aside from which, the California horse lacks the perfect gentleness and steadiness required of a thorough good draught horse. Naturally wild, the native horse is not generally capable of attaining the degree of perfect docility which is a characteristic of the American horse. Nevertheless, in their peculiar sphere, as previously remarked, they are not to be excelled.

MULES.

The necessities of mountain use and travel make these animals requisite to a greater degree than they are in the populous districts of the States. Where ascents are to be made of the steepest kind, and where roads wind through almost unimaginable places as regards the passage of quadrupeds, the mule's sure-footedness stands him in good use. The chief use to which mules are put is packing. A good fair-sized mule will pack a load of two hundred pounds twenty-five to thirty miles a day, for several days in succession, with but little feed. The mules are of different breeds—native, and imported. The former are of medium size, and are hardly ever above fourteen hands high. The Sonoranian kinds are about the same height.

NEAT CATTLE.

The cattle here are all of an inferior kind, no attempts being made to improve them. The result is, consequently, that the breeds remain in a similar state of inferiority from year to year, greatly to the detriment of the raiser.

SHEEP.

For the raising of sheep the county is eminently adapted, and flocks are very numerous, although the number now being held is but a moiety of what the county should contain. The first breeds were of the very inferior New Mexican sorts, which were driven into the State some three and four years since. In

proper hands the breeds have, by careful management and crossing, improved greatly. It is found best to cross gradually; that is to say, not put two extremes together, as the common New Mexican and anything of a superior Merino. The most approved mode of procedure is to cross the common ewes with, say, an eighth full-blood Merino, the next year with the same, and the year afterwards the produce of this cross by a half or full-blood. The increase of flocks is hardly to be credited, as they almost double the original number in eighteen months from the time of commencing. The rams are put to the ewes, by considerate breeders, every eight months, so arranged that the lambs are brought forth when the weather is favorable. The wool produced is not as yet of a very superior character. Constant crossing will, in time, enable the character of the wool to increase in superiority.

BEES.

A great deal of doubt was at first entertained throughout the entire State whether bees could work in this climate. The experiment was made and succeeded so well that now bee-hives form a desirable adjunct to every farm. In our county bees were first introduced by the agent of the celebrated apiarist, Mr. J. S. Harbison. At all seasons of the year they do well, and when all other means of production lack, the honey-dew which covers the willow trees offers abundant means for their benefit.

RASPBERRY CULTURE.

BY J. A. WARDER, NORTH BEND, OHIO.

THE ripening of the raspberry usually follows close upon the season of the strawberry. Indeed, the earlier varieties appear upon our tables and in the markets before the latest strawberries have disappeared. The raspberry is thus one of the early small fruits, and it is deservedly a great favorite, on account of its luscious character and high flavor. It is often a subject of animated discussion around the table which is better, the strawberry just passing away, or the raspberry now coming in to share our admiration. Though commanding a higher price in most markets, the raspberry is really a cheaper fruit for the consumer than the strawberry, because there is no waste—there are no hulls to dispose of. A given measure is much heavier, and withal, a given weight of the fruit is more satisfying to the palate than an equal amount of strawberries. The raspberry contains more mucilage. Like the strawberry, the raspberry has been subjected to the improvements of cultivation, guided by the skill of those devoted to pomological progress, and we find corresponding diversity of flavor in this fruit; but there is a difference in the wild fruit also, from which our cultivated and improved varieties are derived. Next to colors, flavors are difficult to describe; perhaps they are more difficult to express in language; and so here we are forced to speak of a large class of raspberries as having the Antwerp flavor, inasmuch as it resembles that of the raspberry of that name.

The raspberry is particularly adapted to the northern temperate zone, nor does it succeed very well in the southern portion of this belt; but some of the more tender varieties appear better suited to the southern portion of the United States than to the central or northern States, where they must have winter protection.

The soil best suited to this plant is a loose friable loam or a loamy clay, moderately rich and deep but sufficiently dry. We find the eatable wild raspberries growing in moist lands, and also upon rocky and stony hills, but generally in the richest soils of the country where they abound.

Asa Gray informs us that there are six species of the raspberry in this country, and eleven of the bramble family, the genus Rubus, which includes also the blackberry within its members. Of these six, which are raspberries proper, there are but two species which furnish the fruit that we cultivate for table; these are the Rubus strigosus, and the Rubus occidentalis—the American red raspberry of Downing, and the Thimbleberry or Black-cap. Each of these species has its varieties, which are liable to be indefinitely increased by cultivation, but all the American raspberries which are cultivated for their fruit belong to one or other of these species. We have, besides these, at least four species of the raspberry, but they are chiefly admired for their flowers, or as botanical curiosities, the fruit being smaller and of indifferent quality. The other species of this genus bramble, which constitute the true blackberries, are characterized by having the numerous achenia of which the berries are composed united with the fleshy receptacle, and separating with it when ripe, not leaving it, as in the raspberry proper, upon the stem.

In its botanical characters the Rubus strigosus, or American Red, with its varieties, very closely resembles the European species, Rubus idæus, and was confounded with it by the early writers, and is even now sometimes called the Antwerp raspberry in some gardens where it is propagated. We cultivate several varieties of this species, which is known as the wild red raspberry, and which is common nearly across the continent north of latitude 41 or 42 degrees Of these are the kinds known as the Allen, Kirtland, Catawissa, &c., which show a close affinity to this species, and are probably all American in their origin. There are other varieties, which have attracted less attention because of the inferiority of their fruit. The Rubus occidentalis is a very distinct species, characterized by its bark and foliage being glaucous, by having hooked prickles upon the leaves and stems, which last are recurved, and are prone to root at the ends, like the walking fern, thus propagating itself and spreading the plantation by this curious natural method of reproduction by layering. This peculiarity is not noticed by our own botanists, nor by others, so far as is known, though it may be considered a very distinct characteristic of the species. Another peculiarity with this species is that it seldom multiplies itself by suckers, which is the very common method of increase with the Rubus strigosus, that never roots at the ends of the stems naturally; indeed, they seldom recurve sufficiently to approach the ground. This species also has its varieties, distinguished by the size and color of its fruit, and also by the color of the bark and foliage.

Mr. Gray says: "Some curious forms are known, with fruit intermediate between this species and the strigosus." Can he mean such as the Catawissa and the Purple Cane? The former appears to belong to the strigosus; the latter unquestionably belongs to the occidentalis; so does the American White, a poor and rather dry fruit, and varieties of the Black-cap known as the Doolittle, Miami, the ever-bearing sorts, for that distributed as the Ohio ever-bearing raspberry is not the only one known with a propensity to produce an autumnal crop of fruit: the same tendency is often observed in plants of the common Black-cap, and new seedlings of ever-bearing character are frequently produced, some of which bid fair to excel it in productiveness and excellence. Of the American kinds we may assume that they are all hardy, though even these are sometimes injured by our changeable winter climate south of latitude 42 degrees north, where we have no continuous protection from snow as further north, where I have seen the tender European varieties bearing abundantly at Montreal, after having been covered with six feet of snow during the winter.

The varieties of the European species, Rubus idæus, whether they have

originated upon that continent or this, are those which attract most attention upon our horticultural tables. They may mostly be embraced in a class, Antwerps, characterized by their foliage, by their spines or bristles, and by the peculiar flavor of their luscious fruits, to which those of the American Red bear a close resemblance; hence it is often called a Red Antwerp. Among these numerous varieties we find all the most celebrated raspberries, from the Fastolff and Antwerps, and European ever-bearing sorts, to the delicious fruits of the same class that have originated from seed in our own country, and chiefly produced by that indefatigable pomologist, Doctor Brinklé, whose Orange has deservedly attained a high notoriety. All of this class of raspberries are easily winter-killed; they are tender, and need some sort of protection, and are hence much better suited to amateurs than to market gardeners. We have been told that it is an easy matter to protect them, and we are credibly informed that whole fields are covered by using the plough, after pegging down the canes. This may be so where the growth is moderate, in which case it is less susceptible to the injury from frost, and much more flexible; but whoever may attempt to plough a furrow over the sturdy canes of the brittle Fastolff, that are eight or ten feet long and half an inch in diameter at the ground, will have something of an undertaking upon his hands, rivalled only by a similar attempt to plough dirt over the still more stubborn canes of the Catawissa, with their numerous and sturdy branches standing out in every direction. The burying or covering with earth is often done with the spade, a boy bending and holding down the canes while a man throws a little earth upon them—a very little will answer as a protection, just enough to cover them so that they may thaw in the dark.

The great difficulty, however, is not so much the severe cold as the spring frosts. When well buried, or even if well covered with weeds, brush, cornstalks, or evergreen boughs, or any other litter that will produce a partial shade, these raspberries will survive most winters very well. The Catawissa almost always escapes the cold; but as spring advances the raspberry very early begins to grow, the buds burst, and they must be lifted from their winter quarters. If this be delayed a few days, the white shoots will have started and cannot bear the rude winds of March, much less the spring frosts to which they will probably be exposed. Catawissa raspberries have suffered more in March than during the whole winter. Against winter's cold, indeed, this variety appears proof.

While we must admit the superior excellence, size, and beauty of the European varieties, their tenderness will, with most propagators, prevent their extensive introduction into the fields of the market gardeners. Amateurs will continue to produce them, but our markets will be chiefly supplied with the hardy kinds, even though they be voted inferior by the American Pomological Society. We are told that on the Hudson river fields are planted with a variety of the Red Antwerp, which has received its American cognomen from that stream, the *Hudson River Red Antwerp*. Cultivators of these fields find it to their advantage, for the New York market, which is largely supplied with this raspberry, to bury their plants with the plough. While speaking of this variety it may be well to mention that it has never been extensively planted in the western States; few cultivators know it, and those who have it know full well how tender it is, and how unprofitable in fruit.

The *Purple Cane*, or American Red Cane, according to Charles Downing, which has already been referred to as a variety of the species Rubus occidentalis, is, however, no Black-cap, but a very valuable variety of raspberry, to which the depreciative appellative of "Thimbleberry" is in nowise applicable; this being the common designation of the Black-cap in the hills of New England, was applied to the berry in question at the last meeting of the American Pomological Society, in Philadelphia. Its origin is unknown, but it has been under cultivation for half a century or more, near Philadelphia, New York, and in other places. It used to be called the English, as was once common with every kind

of fruit that was good and not found wild. It was then a great favorite with the housekeeper, and though rather soft for transportation, it is rich in saccharine and mucilaginous matter, of a very good flavor, excellent for dessert, or for preserving, and for wine. It is also productive, perfectly hardy, and every way deserving of more attention than it has received. While a host of new sorts have been introduced to the public with flattering eulogiums, this variety has been allowed to subside into a state of neglect. It has still found warm friends, however, among those who know its merits, and has been named, from its red stems covered with a thick glaucous bloom, the *Purple Cane*. This name was applied with diffidence, but a designation was needed. Mr. Charles Downing calls it the Red Cane, and thinks this more appropriate, while Mr. Oscar Taylor, who took it from Saratoga county, New York, to Freeport, Illinois, says it was called the English Brown. It is perfectly successful, without any protection, in the most trying climate of the open prairies of northern Illinois, where most others have been cut off by frosts; and under a more genial clime it is the most certain, the most productive, and altogether the most satisfactory variety in cultivation—it is the one indispensable raspberry. If the list must be reduced to only one variety for general cultivation, let it be the Purple Cane, or the *American Red Cane*, according to C. Downing.

At the Philadelphia meeting of the American Pomological Society, in 1860, Mr. Charles Downing said of this variety: "I consider it the *farmer's raspberry;* thirty or forty years ago it was extensively cultivated around New York." Mr. Reid confirmed the last statement.

Mr. E. Satterthwait, who has been called the most intelligent and successful cultivator of market fruits in the vicinity of Philadelphia, says: "It is the only raspberry I have found to stand the test. I never found any other to pay, as a market fruit, but the old Purple Cane. It is uniformly an abundant bearer."

Elliot, in his Fruit-grower's Guide, evidently alludes to this variety as the *English Red*, but he does not describe it. Mr. Torrey, the botanist, refers to the color (purple) of the fruit of some plants of the Rubus occidentalis; he is the only botanist who appears to have noticed this.

The *Kirtland* is a favorite wherever known; its origin is uncertain, but it has unmistakable characters of the American Red family in habit, foliage, and spines, in the color and flavor of its fruit, and lastly in its hardiness. Its period of ripening is with the earliest, and the oblong berry is reasonably firm, bearing carriage to market as well as any of the soft berries, and better than some. The excellent naturalist whose name it bears has been a most devoted fruit culturist, and has originated many valuable varieties of fruit, particularly of the cherry; but he disdains all credit for this berry, which he thinks he obtained from some one else. It was growing in a corner of his grounds many years since. All the plants of this variety which are known have sprung from this source, and our pomological societies, not recognizing it as any known sort, have done well to confirm the name given to it by his friends, in compliment to the eminent pomological labors of Professor J. P. Kirtland, of Cleveland, Ohio. Mr. Richmond, of Sandusky, Ohio, was one of the first to appreciate its excellence as a valuable market fruit, and he has distributed plants of the Kirtland raspberry. This variety has a tendency to produce an autumnal crop, and may yet furnish valuable seedlings as perpetual varieties.

The *Allen* has had a singular history since its very wide introduction from the neighborhood of Buffalo, New York. Cultivators give the most contradictory accounts of its fruitfulness; some find it an abundant bearer, but the weight of testimony is against it, and make it out to be almost worthless. It is probably an American variety; it is perfectly hardy and has a delicious flavor. There must be some mistake about it; probably there are two sorts.

The *American Red* is the chief representative of the species *R. strigosus* in cultivation. It is only a good variety of the wild red raspberry. A very good

variety it is, too, and yields a remunerative crop. There is a slight difference among the plants in their native state and in the raspberry fields. There are better and worse; the former are exceedingly satisfactory, and constitute the favorite market berry in many cities. This is often called the Red Antwerp.

American Black.—This is the common wild black raspberry, reduced to cultivation. It is very vigorous, hardy, and productive if properly treated. The Black-cap, as it is familiarly called, is very largely grown for market on account of the qualities above mentioned, and because its firmness fits it for transportation; hence it is largely shipped to northern markets by railway. Though rather dry, it is rich, and its flavor is heightened by cooking, for which purpose it is in great demand. The proportion of seeds is large, and this unfits it for a place on the table or in the garden of the fastidious amateur. There are seedling varieties of this kind, some of which are improvements; among these, that called *Doolittle* has been very highly spoken of by cultivators. Like the wild raspberry, from which it has been produced, it is very productive, and where the taste of the market has not been spoiled by the finer varieties it commands a good price. Mr. B. Hodge, of Buffalo, New York, sold 2,000 quarts from an acre—about sixty-two bushels. Mr. Doolittle claims to have improved it from the common wild variety by some peculiar plan of propagating it by the tips only from young plants, never from old ones. This is doubtful, or questionable at least, and it is more rational to suppose that the good qualities which it possesses are owing to judicious selection and good culture. There are other varieties of the Black-cap in cultivation which have a local reputation. Among these is the *Miami*, which is characterized by the brownish tint of its berries, which are of large size. The yellow-stemmed variety, sometimes called the *American White*, is a sort of Albino Black-cap, every way inferior to the others, and yet it has some admirers.

TENDER VARIETIES.

The *Antwerp* stands at the head of these, and is remarkable for its size and high flavor. The *Antwerp of the Hudson River* has already been alluded to. The *Yellow Antwerp* is sometimes productive when it escapes the winter; the fruit is very delicate. The *Fastolff* is a highly recommended European variety, of delicious flavor, but not successful in general culture. *Knevet's Giant* is one of the largest and best of this class, of fine appearance and flavor. *Franconia*, said to be productive, large and firm enough for a market berry.

A whole class of seedlings from some of these foreign raspberries has been produced in this country. Some of these are considered very promising, but they are equally tender with the European. These have chiefly resulted from the labors of Dr. W. Brinckle. They are named Colonel Wilder, Cope, Cushing, Emily, French, Fulton, General Patterson, Orange, Walker, Woodward, &c. Many of these appeared to have great promise, but few of them have entered into general culture. The *Orange*, however, is extensively cultivated; it is a beautiful pale fruit of great size and delicate flavor. The plant is so tender that it must be protected, and on clay soils this is particularly the case; upon sandy soils it does better. Mr. Knox, of Pittsburg, and Messrs. Knox & Kidder, at Chicago, grow it successfully; at the latter place it is on sandy soil near the lake.

The *Hornet* is a European variety that is attracting great attention where known. It bears enormous crops and is of fine quality; it sells at the highest price in the market on account of its size and flavor.

EVER-BEARING OR AUTUMNAL-BEARING VARIETIES.

There is no reason why we may not one day have perpetual raspberries, as well as perpetual roses. There is nothing unreasonable or impossible in it, but

as yet we have not seen any really continuous fruiting variety. People will differ in their tastes, and some will wish to have raspberries, or some other distinctive variety of fruit, ever before them; while others of us think that the gradual succession, in the natural order of ripening, of different kinds of fruit, from early summer to the end of winter, is more in accordance with the intention of the Wise Giver of all these good gifts.

Those who desire to pursue the search after a perpetual raspberry should persevere with seedlings from the best and most continuous bearers, and they may hope for success eventually. That a perpetual berry is not the normal type is very apparent; and this is more patent when we observe, among the seedlings that have been produced in this class of perpetuals, many that flower most abundantly, and some of them have double flowers, but all abortive. This seems to show that there may be a limit to the advance in this direction. This fact also induces the inquiry as to the perfectness of the inflorescence of all raspberries. Some varieties, among which the Allen may be prominently presented, have failed to produce full crops, though they had bloomed abundantly. We find the aberrations from the normal type of inflorescence in another species of the same natural family of Rosaceæ—the strawberry is found with imperfect flowers. Who has examined the organs of the blossoms of the Allen raspberry to see if they are perfect, as externally they appear to be? It is possible there may be some defect, and some persons say that this variety needs extrinsic impregnation to induce fruitfulness; others have failed to succeed even with this treatment. The fruit of this variety is so beautiful that it is to be hoped something will be discovered to insure its productiveness.

The *Catawissa*, as already mentioned, appears to be nearly allied to the American Red, and to belong to the species *strigosus*. It is a hardy, vigorous plant, making very strong branching canes, every twig of which produces abundant flowers and fruit, until checked by the frost. It is not prone to sucker; and it is evidently different from the species *occidentalis* in all its characters, as well as never recurving and rooting at the tips, as has been erroneously reported to be the case. That is, it never does so naturally, but it has been discovered that one of the best and readiest methods of propagating this variety is to force it to root at the ends by layering them. This can only be done to advantage with the slender trailing shoots of young plants that are not yet in a bearing state.

The *Bagley* has been introduced, within a few years, with a high character for bearing, but as it has not been generally cultivated, little can be said respecting its merits. It is supposed to be of the American species, since it is claimed to be hardy.

Rivers's Monthly is one of the true Antwerp tribe, said to be a fine fruit, but, under common treatment and neglect, it is unproductive. It is also tender, though that is a matter of small moment in a perpetual raspberry; for we expect the fruit, which constitutes its chief value, to appear upon the young canes of the current year's growth.

The *Ohio ever-bearing* raspberry is an autumnal Black-cap, which, in some soils, produces a most abundant crop of fine fruit in September, which is larger, more juicy, and better flavored than that produced by the same plants in July. There are several sorts of this fruit, and the different stocks may vary a little in their characters; certain it is that some plantations are much more productive than others, and a set of plants has been known to be very productive in the autumn one year, which failed to show a summer blossom the next season; although wild Black-cap plants that had never before shown a tendency to autumnal bearing, produced a partial crop in September of the same year. Something may depend upon the soil; much more influence may be attributed to the treatment. To insure a good fall crop, it has been recommended to obliterate the summer fruitage by severe trimming in the spring, removing all

the bearing wood to the ground; the young canes that come up will then branch and blossom, and fruit abundantly. There are some seedling Black-caps at Richmond, Indiana, which promise to be exceedingly prolific, and the berries are of large size. They were produced by Mr. John Conley, of that city, in whose garden a plat of the young tips planted in the spring produced a large crop of fruit the ensuing autumn.

The *Belle de Fontenay* and the *Merveille de Quatre Saisons* are undoubtedly different plants, and we have the two sorts in this country, bearing these two names, one of which is inferior to the other. They are, however, so mixed that we find cultivators in so intelligent a body as the American Pomological Society proposing to use the names as synonymous for one variety, which they mean to identify and to particularize by the characters of its foliage and habit, and call the Belle de Fontenay. This is a vigorous plant, throwing numerous suckers during the season, many of which produce blossoms and fruit. The pictures of the Merveille which come to us from Europe, on the very best authority, (that of Bivart,) represent a variety that is truly marvellous in its productiveness, and cannot fail to be highly satisfactory to the planter; but it must be confessed that with all the care that has been bestowed upon it few persons have been satisfied with this variety.

The ever-bearing, or more properly the autumnal bearing, Black-cap varieties, the Catawissa and the Belle de Fontenay, may be considered satisfactory for a late crop. Mr. Pierce, of Washington, D. C., reports that he has had a succession of fruit from the Catawissa during the whole season, and in quantities sufficient to send to market.

THE SOIL AND ITS PREPARATION.

Almost any land of reasonable fertillty will answer to grow the raspberry, but a good strong loamy clay or a sandy loam is generally preferred. The aspect, too, is not considered a matter of much importance, though the coolness of a northern slope, with the moisture incident to a deep sandy loam, will be found highly advantageous for the production of large and luscious fruit, and for the continuance of the season of ripening; for, on clay lands, the crop is sometimes cut short by continued drought, and dried up by the burning sun. To insure good crops, the soil should be thoroughly prepared, by trenching if in the garden, or by trench-ploughing if in the field, unless a plat of new ground be planted, when the raspberry may do very well among the stumps.

PLANTING.

The planting should be done as early as practicable in the spring, not only to insure a good start, but because the bud for a new cane, which is formed in the preceding season, begins to grow very early, and is easily broken and destroyed. On this account, some planters recommend fall planting, which, indeed, is very desirable with the hardy varieties, and where canes are planted, provided always that proper care be taken to protect the plants from the heaving effects of frost, which, in some soils, would throw them all upon the surface and thus ruin them. Nothing is better than forest leaves as a mulch to prevent this effect of frost; indeed, mulching should always be attended to after fall planting. The varieties of the species occidentalis are propagated by the rooted tips; these have no cane with the young plants, and may be better set out in the spring; they need care in putting them into the ground.

The planting is a very simple process, and should be conducted upon the general principles of gardening. Having determined whether to set in rows or in squares, light furrows are drawn across the well-prepared field, and the plants are set in the fresh earth, taking care not to put them too deep. The distance at which the plants should be set will depend upon the thrift of the

variety, but there is no economy in crowding them; give plenty of room, whether in rows or in hills, and never plant near to a fence, as was the common plan in garden culture. The raspberry needs room to expand, and will repay an ample rent for the space occupied. Rows six feet apart, with a plant every three feet, were found too close at the end of the second year. The Black-cap, the Purple Cane, the Fastolff, the Allen, and the Catawissa, will do very well at six feet apart each way, if planted in squares; they should not be set closer than this. The American Red, Kirtland, and Brinckle's Orange, and some others less rampant in their growth, may be set nearer. A single plant is enough at each station, and these should be cut back pretty closely; indeed, it is best not to allow them to fruit the first year, as the small amount of berries is often furnished at the expense of the plant, which has not power to produce a cane for the next year, and to ripen fruit at the same time; the wood being biennial, the growth of a good cane is essential to the success of the plantation.

CULTURE.

The plants should be kept clean by the plough or cultivator, used frequently during the first season at least, to insure a good crop the next year. The culture afterwards is very simple, and consists in an occasional ploughing, or the whole surface may be covered with a coarse mulch, such as cornstalks, which will keep down the weeds and retain the moisture of the soil; a good coating of cornstalks will last for two seasons, after which the use of the plough in the winter or spring will be again found advantageous. Those who feel that they are devoting too much space to the raspberry plants, by setting them at the distances above indicated, may use the intermediate soil by planting some low hoed crop the first year, such as potatoes, cabbages, or beans; but, after the first season, there will be no more room than the raspberries will require if they be thrifty.

Stakes and trellises of different kinds are usually recommended and adopted by most cultivators, but they are unnecessary, and a needless expense and trouble; one argument has been advanced in favor of the stakes, applied particularly to the Black-cap variety. It was this, that it is cheaper to pick the berries from stakes, for, when four or five strong canes were tied to one stake, the fruit branches all looked outwardly, and the berries were all well exposed and easily harvested. Now, precisely the same effect follows the judicious pruning, upon the plan which will be indicated below. When stakes are used they are made from five to seven feet long, and firmly driven into the soil beside the plants. The canes are tied to them with twigs of the golden willow.

Another plan is to drive the stakes in the rows between the plants; one or two canes from either side are then arched over and tied to the stakes; this gives a good exposure to the fruit, and causes an even breaking of the lower buds. Where wires are used the canes may be spread out fan-like and secured to the wires so as to produce the same results.

Others tie the canes from each hill or plant to those from the nearest diagonals, having four canes to each hill; one is inclined in each direction for the sake of the exposure to the sun and air by this kind of arching. This plan, of course, precludes cultivation or easy locomotion for the fruit gatherers, and it is therefore undesirable, especially where we do not need any extra exposure to insure the ripening of the fruit; but the buds will break better from canes thus arched over than from those that are kept upright. By arching over each alternate space only, access can be had for picking and cultivating. This plan requires closer planting than is recommended; the squares must be four feet apart.

Some persons use trellises made by driving stakes or posts into the ground on each side of the row, and fastening a strip or pole on their tops; these sup-

port the raspberry canes which may be tied to them. Wires are also used by some cultivators for the same purpose. Stakes and trellises possess this advantage, however: the new shoots are exceedingly succulent, and are very easily broken by the wind; hence the apparent value of these supports, which will, in a degree, prevent this; but the loss by breakage is not at all commensurate to the expense of staking.

Trimming and training upon the plan now to be proposed are very simple processes, and may be performed at any period during the winter or early spring, when the canes are not frozen. The tender varieties may be left until the last, unless pruned in the autumn to prepare for burying, or for the sake of the trimmings, which may be laid over the plants for a winter protection. All the old wood is first removed as closely as may be, and some gardeners advise that this be done at midsummer, immediately after harvesting the crop, when the feeble shoots should also be removed in order to strengthen those that are left. The new canes may then be shortened, so as to strengthen the growth of the laterals and to develop the buds on the lower portions of the cane.

How good soever this advice as to summer pruning, it is seldom followed, and we generally reserve the job for a mild winter's day. In rich soils there is less need for the summer pruning; indeed, some of the varieties grow only too strong if left alone with all the canes they may throw up, without any trimming or culture after taking the crop, and even when the field has been given up to a rank growth of weeds. It cannot be denied, however, that judicious summer pruning and pinching would so direct the energies of the plant and the disposition of the buds as to improve the crop materially. In trimming, at whatever season performed, all slender shoots should be removed, leaving only the strongest, and not more than three or four in each hill. These, in the winter pruning, should be cut back very freely, taking more or less, according to the material length of the cane and the object we have in view for the crops.

Those varieties which are disposed to branch should be spurred in to about two or three inches, particularly the varieties of the species occidentalis, as they may thus be intertwined, and render each other a mutual support without the necessity of tying. When there are no branches to spur in the canes may be confined together in each hill, by using a willow tie, as is always done when stakes are used. But we have been supposing the absence of all support, and are providing for the pruning of the canes in such a manner that they shall stand alone. Most persons trim the canes too long, leaving four or five feet to the Black-caps, and three or four to the red sorts. The former should be trimmed to three or even less if they are not very strong, and the red varieties from two to two and a half only, except when the canes are unusually long. An accidental observation has shown that the finest lateral shoots, producing the greatest number of the largest fruits, may be forced out of the lower buds; those which in the usual mode of trimming never break, or break feebly, and are afterwards smothered by those above them. This accidental observation has been improved upon by judicious pruners and, by training some canes quite long for early berries, some at the medium length, as recommended above, for the main crop, at mid-season, and by a severe cutting back of others, say, to one foot, for late berries, the season of a single variety of raspberry may be prolonged to six weeks, instead of passing away in two or three. This is considered a great desideratum, and may be practiced with advantage either by the amateur or by the market gardener.

The pruning of the ever-bearing varieties should be somewhat different; with them still greater severity is needed to produce a full autumnal crop, and it is desirable to have that crop come on early in the season to avoid the frosts; for there is not much satisfaction in seeing an abundant display of blossoms and unripe fruit enveloped in a November snow storm. The canes that have survived the rigors of winter and the trials of a changeable spring should be thinned

out more severely than the common sorts; indeed, hardiness is not an essential with the ever-bearing raspberries. If the canes have been frozen, one has less compunction in removing them, and the plant is left free to produce a new crop of wood for later fruits. If, however, they have survived the winter, a few may be left for the summer fruitage—only a few; the new canes should be encouraged, and if too numerous the weakest may be thinned out. If very strong and succulent, it will be well to tie them to stakes or to some sort of supports to keep them from the ground, and from being broken by the wind.

Some cultivators advise the entire removal of all the old wood in the spring—sweeping all away close to the ground. This method insures a free and strong growth of thrifty fruit-bearing canes for the autumnal crop; indeed, some plants will be very poor bearers in the fall unless subjected to such treatment. A considerable plantation of the Ohio ever-bearing Black-cap has been seen without a single attempt at blossoming in the autumn.

The profits of raspberry culture are considerable; the outlay is small; the annual expense trifling compared to some other crops. The return is almost immediate, since plants bear a good crop the second year, increasing the next, and continuing profitable for five or six years. Two thousand quarts (about sixty-two bushels) is a fair crop from an acre. At ten cents a quart, this produces $200, or, at wholesale rate, $2 50 per bushel, making $150. But at higher rates, which are very commonly realized, the showing will be better: say, at twenty-five cents, a very common price for the reds, $400. $500 has been received for the product of an acre.

A fair calculation for an acre of the black raspberry may be made as follows:

DR.		CR.	
To thorough preparation of the soil	$10 00	By average crop after the first year, say 50 bushels, at $2 per bushel	
To stakes and setting	20 00		
To planting, at six feet	5 00	By 3,000 tips rooted	$100 00
To 1,208 plants, at $10 per M.	12 00		30 00
To culture, (first year)	2 00		
To trimming, (annually)	3 00		
To rent of ground, at $5 annually	10 00		
To culture, (second year)	1 00		
Total cost for two years	63 00	Total product	130 00

Annual profit, $67 per acre.

After this period the account will stand thus:

DR.		CR.	
To interest on the above outlay	$6 30	By product of fruit and plants	$130 00
To rent of land	5 00		
To trimming	3 00		
To culture and picking	21 00		
To repairs of stakes, &c	1 70		
Total cost per year	37 00	Total product	130 00

Annual profit, $98.

STRAWBERRIES.

BY J. A. WARDER, NORTH BEND, OHIO.

WHY do not the millions of our population have and enjoy so simple and so delicious, so health-giving a luxury as the strawberry? It is because the thousands of producers and of those who might be producers of this fine fruit are unacquainted with the simple processes that should be pursued in the production of paying crops, and perhaps, also, because they will not take the trouble to create the millions of bushels for the millions of consumers who are ready in all the cities, towns, and villages of our country to pay a full compensation for the labor bestowed on their production.

It is proposed in this essay to give the needed information in all its details, so that any farmer may, at least, grow an abundance of strawberries for the consumption of his own family, or, where favorably situated for producing and selling a large crop, he may take advantage of this method of replenishing his treasury from the pockets of those who cannot or will not produce strawberries, but who are willing to pay for them. The simplest plans will be given, such as are generally pursued in field culture, and also such as are practiced by the amateur in the garden, which, though more expensive, are believed to be the best and most profitable for the production of market fruit also.

HISTORY

The strawberry has been classified by the botanists as one of the large families of the *Rosaceæ*, of which, indeed, it is a very marked member, combining very many of the distinguishing traits of the rose family. Linnæus described but two species of this genus, which he named *Fragaria*, as is supposed from the delicious fragrance of its fruit. According to Asa Gray, our own distinguished botanist, we have two species in North America, the *Fragaria vesca*. and the *F. virginiana*, our wild strawberries, from which have been derived very many fine seedlings; but in Europe, Asia, and South America, and perhaps also in Africa, other species have been found, some of which have been cultivated, and improved varieties have been obtained from them. Hybrids from some of these have also been procured, and it is often difficult to classify our cultivated varieties, and to decide to which of the original species some of them belong.

The naturalist who described the strawberry, not being so much interested in the fruit as the cultivator, overlooked a peculiarity of this plant which has caused a great deal of discussion in horticultural circles. This consists in a departure from the regular or perfect character of the flower, observed in most species of the natural order to which this plant belongs. In them the stamens and pistils are perfectly developed in every flower, but this is rarely true of the strawberry, though, to a casual observer, many of the varieties would appear to have perfect flowers. A careful observation will show that a large proportion of such flowers will not produce fruit of full size and perfect form, and that generally only a very small proportion of the flowers will be followed by large, handsome fruit, while a great many of the blooms will wither and dry up without producing the desired berry.

Further observation of strawberry flowers will very soon disclose the fact that some plants produce blossoms in which the stamen does not make its appearance at all, being rudimentary and concealed. These constitute what are called the *pistillates*, and among them are many of our most highly-prized American varieties; for though they have no perfect stems of their own, they

are easily fertilized by other stamen-bearing plants even at a considerable distance from them, the pollen being conveyed by insects or wafted by the wind. The former agents, by the way, undoubtedly exert a very important function in the fertilizing of many blossoms, even those which are really perfect in their organization, having both stamens and pistils in the same flower.

The critical observer of strawberry flowers, not perhaps in garden beds of cultivated varieties, but among the wild plants that deck our hillsides and prairies, meadows and fence-rows, will find another class of plants, with flowers that are almost exclusively staminate, the pistils being so imperfect as to be quite inconspicuous; these rarely produce fruit; the berries are small and deformed, and scarcely amount to one or two per cent. of the blossoms. Such plants are well called *barren*, when compared to the pistillate varieties beside them, or to those favorites which are so highly prized in the fruit garden.

Based upon a notice of these facts, after a long and patient series of observations upon the peculiarities of inflorescence, and the amount of fruitage, of many varieties of the strawberry, the Cincinnati Horticultural Society issued its report. In this the following conclusions or postulates were arrived at:

2. "The varieties of inflorescence consist in the greater or less development of the stamens and pistils respectively, upon which are based the terms and classification '*staminate and pistillate*,' or male and female."

3. "These classes are *permanent* aberrations from what Linnæus considered the normal condition of this genus of plants, as well as of its natural family, ROSACEÆ."

4. "No *pistillate* plant will bear a perfect fruit if kept entirely apart from staminate varieties."

5. "No *staminate* plants, which we have yet seen, can be depended upon by the cultivator as heavy bearers; though, from some unknown causes, the pistils may be so well developed as to be followed by a good crop, some years, and in some situations."

6. "There is no such thing yet known to us as a perfect-flowered strawberry plant, in which the blossoms will *all* be *uniformly* so well provided with both sets of organs as to be followed by perfect fruit every year."

7. "The only method of producing this delicious fruit with any degree of certainty as to the result is that now adopted by intelligent cultivators, viz: to set out plants of both the sexual classes, * * * selecting such pistillate kinds as may prove of good size and flavor, and only so many *staminates* as may be necessary for impregnation."

8. "The runners from a strawberry plant are as integral portions of itself as the branches and buds of a tree, and, therefore, we may always propagate any variety by this means with as much certainty as we propagate any variety of other plants by cuttings, or by grafting and inoculating."

After the rendering of this report, the remarkable bearing properties of a variety then under trial, and afterwards designated as Longworth's Prolific, induced some of the committee to suggest that a class should be established which might be called the *Hermaphrodites*, or those having perfect flowers, for nearly every blossom was followed by a well developed-fruit. Still later, the Willson's Albany seedling has deservedly come into universal notice for its great productiveness. Here, then, we have at length found two staminiferous varieties that appear to form an exception to the postulates Nos. 5 and 6, above cited, and since these two varieties have become known and extensively cultivated, the proposition number 7, in that report, may well be somewhat modified, but good cultivators will continue to grow the pistillate varieties because of their excellence, and their profitable returns of an assortment of choice berries to reward us for the little trouble requisite to impregnate them. The careless amateur cultivator, who is unwilling to bestow that little trouble, may plant these

two staminiferous varieties with a certainty of an abundant yield, but in the gratification of his palate he must be restricted to a limited range of flavors.

For further elimination of this topic, and for a list of the species of strawberry, the reader is referred to the article on *Botanical Classification*.

For the amateur cultivator there is nothing which he can plant that is so satisfactory as the strawberry; nothing that will so soon reward his labors. The strawberry is the earliest of our small fruits. It is easily, as well as quickly produced, most acceptable to all palates, abundantly productive, and remarkably conducive to health. Every one who controls but a few yards or rods of earth should plant strawberries.

HOW TO DO IT.

Without further preface, then, I shall proceed with my story, and endeavor to describe the methods essential to success; in other words, show my readers "*how to do it.*" First, it may be asked, What is the best soil for the strawberry? This plant is cosmopolitan in its nature, being found, in some of its species, in nearly every quarter of the globe, flourishing naturally in a great diversity of soils. Some are found almost upon the bare rocks, insinuating their fibrous roots into minute crevices among the debris of the minerals and vegetables there accumulated in the lapse of ages; others on the sand dunes that have been the sport of waves and winds until clothed with protecting vegetation. Then, again, we find some growing upon hard or arid gravel ridges, while others are found luxuriating upon loams and clays, and some upon the peaty and light moulds of the prairies, or even in the wet and spongy soils of our marshes. With such a diversified habitat, taking the strawberry from the lowest flats, near the level of the sea, to some of the highest alpine regions susceptible of supporting vegetable life, and upon soils as varying, we may well expect that this plant might be grown in almost any soil that is capable of cultivation, and such appears to be the fact; but here we find a great difference in the results, for though the strawberry may be planted successfully in almost any soil, if properly prepared, experience has proved that they are more successfully grown in those that contain a portion of clay; good loamy soils are particularly adapted to their cultivation. A warm gravelly or sandy slope has some advantages; the plants will not be so much disposed to run to leaf; they are rather inclined to produce blossoms and fruit, but they will be much more likely to suffer from drought, and will need irrigation. Where this is practicable the happiest results may be expected; and in a light soil, with such treatment, Mr. Peabody* claims that he can induce such a state of fruitfulness as to check the growth of runners and leaves, and to produce a long succession of flowers and fruit.

While it is claimed that any soil capable of cultivation, if well prepared, may yield a return, if planted with the strawberry, we observe that this fruit is more successfully grown on some soils than on others. Most cultivators prefer a loose, rich, friable loam, with sufficient clay to give it some tenacity, but not enough to make it heave and run under the influence of frost. Such clayey lands are preferred, because of their strength, and because, when properly prepared, the strawberry grows vigorously and becomes stocky; sending its fibres deeply, it is not liable to suffer from drought, as in sandy or gravelly soils. Newly-cleared land is very generally preferred by large cultivators, because if the timber have been heavy it is generally destitute of the seeds of white clover and blue grape, which are very troublesome weeds in the strawberry plantation, and also because the strawberry appears to delight in a soil containing a large proportion of leaf-mould; and in such land it always yields a large return of fruit in proportion to the foliage grown, unless, indeed, the soil be very rich or rank.

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* Of Georgia.

In some of the eastern States, as in Maryland, where large plantations of the strawberry are cultivated for market, the soil is naturally thin. New land is there preferred, as it will yield a better return than old land, to which it is necessary to add manures. Mr. Peabody also finds that his best crops are produced upon light soils newly cleared, and containing a considerable proportion of leaf-mould; and his suggestions upon this point may prove of great value, whether or no we succeed in producing ever-bearing strawberries, as he claims to have done.

PREPARATION OF THE SOIL.

The preparation of the soil for the plantation is a matter of considerable importance, since upon this depends, in a great degree, the success of the undertaking. The thoroughness of the preparation for this, as for other crops, will generally be found to be in the inverse ratio to the extent of ground to be planted. When new ground is selected, it consists in the complete clearing of the land by chopping, grubbing, and burning; then comes the breaking up of the soil with the plough, and this is more or less thorough according to the number and nature of the roots of the forest trees, but is always imperfect. After ploughing, the heavy drag or harrow is used, crossing in opposite directions and tearing up the roots as completely as possible; these are gathered and burnt or removed before planting. In the preparation of old or cleared land, or of prairie land, the ploughing may be done more thoroughly, and the clover or other sod should be completely reversed so as to be entirely hidden. In such a field, in soils that are sufficiently deep, the double Michigan or trenching plough should be used, or the sub-soil should follow, so as to make the tilth as deep as possible. Here, also, the harrow should be used before planting. Rocky soils will present serious obstacles to such thorough preparation, but all loose stones should be removed, and large rocks should have the soil loosened about them by hand labor with the spade and mattock. Shallow soils that have an unkind sub-soil, unfit for bringing to the surface, should still be stirred deeply by the use of the lifting sub-soil plough. All this applies to field culture of the strawberry, to the preparation of strawberry fields for the million; but for garden culture, and especially for the amateur ambitious of producing the greatest possible amount of fruit and the finest possible specimens from a limited piece of ground, or for the cottager who has but a few yards to spare for the luxury he covets, a much more thorough preparation by the spade is recommended. I refer to trenching the soil, digging it two or three spits deep. This process is very simple, but as it may not be understood by some it shall be described.

TRENCHING.

The surface having been levelled by reducing elevations and filling the hollows, the workman begins at one side, or at one end of the plat to be dug, by opening a trench about eighteen or twenty inches in width and of equal depth. The soil from this is thrown aside and left to fill the last trench. Into this trench the top soil of the adjacent strip is thrown as dug by the spade to the depth of that tool, say nine or ten inches; then the lower soil in the second strip is dug and thrown on the top soil in the first trench. Thus the two layers of earth are reversed, and in some countries a most uncongenial soil is brought to the surface; and though we have the grass and weeds buried deeply out of the way—though we have broken up the soil thoroughly and admitted the air and frost to do their meliorating work for us, we may find a sterile surface upon which neither weeds nor plants will vegetate. In such a soil bastard trenching should be practiced. This is a modification of the process so performed as to retain the two layers of earth in their relative position. It loosens the sub-soil, but does not bring it upon the surface; it is like sub-soil ploughing. The trench is to be

opened as before, across the end of the plat, and the two layers or spits of soil are to be kept distinct; the top spit of the next trench or strip is then dug and also thrown out with that from the first; the sub-soil of the second is then thrown into the bottom of the first, and the top soil from the third trench is dug and thrown on top of this. The relative positions of top and bottom soils are thus retained, though the whole has been dug to the full depth. In such trenching it is often desirable to apply manure to the lower stratum of crude soil. If we desire still further to increase the depth of the tilth, the ground may be dug three spits deep by a modification of the process, or the bottom of the lower spit, after the loose dirt has been thrown out, may be thoroughly broken up with the pick or mattock. Drainage in all heavy soils will prove of great advantage to the strawberry, not only on account of its removing excess of water, but more especially on account of the effect it will have to keep such soils open and friable, and hence humid, during a drought, by admitting the air with its hygrometric treasures.

MANURES.

As already hinted, fertilizing materials are seldom needed in our rich western lands, though necessary on more sterile soils, and on old, exhausted plantations, and they may be mixed with sub-soils of an inferior, unproductive character. The great danger in the use of enriching manures is, that they will produce too great a growth of leaves, at the expense of the supply of fruit. A tendency in this direction is often observed in many of the very fertile lands of the west, which are rich in vegetable matters. The use of lime would have a very fine effect upon such soils, combining, as it does, with the humus, neutralizing acids, and hastening the decomposition of organic matters. Another objection to the application of barn-yard manures is the introduction with them of the seeds of numerous weeds, which are the bane of strawberry culture, for they are apt to be neglected and allowed to injure the crop, and require a considerable expenditure of labor for their removal. This objection does not exist when the manure is mixed with the sub-soil in trenching. When composted, also, the manure is in a much better condition for the plants. The diluting materials may be leaves, leaf-mould, sods, muck, or the scrapings from fence-corners and roadsides. Special manures have been recommended by some gardeners, especially old tan-bark, on account of the supposed appropriateness of its tannic acid, which is a large constituent of the strawberry plant. Mr. Pardee recommends solutions of salts. "About the first of May, and again ten days or two weeks later, three times each spring, it has been our custom liberally to sprinkle our choicest beds with a solution, in six gallons of water, of one quarter of a pound each of sulphate of potash, sulphate of soda, and nitrate of soda, with one and a half ounce of sulphate of ammonia. * * A continued series of experiments has proved to our satisfaction that it is valuable—increasing the size, quantity, and superiority of the fruit. * * * One quarter of a pound of sulphate of potash, sal soda, glauber salts, and one and a half ounce of sulphate or muriate of ammonia, in six gallons of water, or either of them applied alone, we have found a useful substitute. Liquid manures, composed of cow or hen droppings, or even soap-suds, we have not found good fertilizers for the fruitfulness of the strawberry, but they will increase the runners and promote the growth of the plants." The testimony of others also might be quoted against overfeeding the strawberry with very rich manures; the fruitfulness of the crop will be diminished, while the growth of the plants is increased—the reverse of which is what we desire.

MULCHING.

The applications of mulching materials is so nearly related to manuring, and so often consists in the use of manurial agents, either directly or indirectly, that their consideration very naturally follows in this place.

A mulch may be defined any covering of the surface of the soil that will check evaporation of moisture, attract dew, prevent the scorching and desiccating influence of sunshine, and at the same time modify the sudden transitions of the temperature by preventing the escape of heat. To fulfil all these indications, the mulching materials should be bad conductors of heat, and the excellency of the substances used will be in the direct ratio of this quality.

The first substance, and that which most naturally presents itself in connexion with the name of the plant under consideration, is *straw*, which may be laid between the plants, and was so used at a very early period of its culture, not so much as a mulch, as for the purpose of keeping the fruit free from dirt and sand. Some writers suppose that our common name for the fruit arose from this circumstance, which would appear a very natural derivation for the word; but the orthography used by the first writers would lead us to suppose that they meant to indicate the habit of this plant—that it was wont to *stray* by means of its runners.

Thus the old ballad has—

"Stra-berries ripe and cherys in the ryse."

Straw is a very good mulching material, and admirably fulfils the indications above required, but it is a somewhat expensive application, and needs renewing annually when used. It should be applied liberally in the autumn, as a winter mulch, for protection of the plants from freezing and thawing. This is particularly desirable for young plantations. After harvesting the fruit the straw must be removed from the ground before cultivation can be resumed. To avoid this necessity some have recommended the use of cut straw, which will not interfere with the cultivator, but will readily mingle with the soil. With the same object some recommend the use of chaff from the threshing floor, but this has a serious objection attaching to it, in that it is a frequent means of the introduction of the seeds of weeds and grasses. Grass cut upon the lawn, particularly the late cuttings, what is called by the old English farmers fog, is soft, neat, free from seeds, and makes a very good mulch, but it does not last so long as the straw, and is of less value for protecting the fruit the next year, unless it be renewed from the early cutting of the lawn in the fruiting season. Where leaves are accessible, particularly those from the forest, they make an admirable winter protection, and may be applied thickly in the autumn, and allowed to remain on the ground; in very exposed situations they are liable to be blown away, but are easily retained by throwing over them some light spray or trimmings of trees and shrubs, which must be removed in the spring, but the leaves should be left to rot upon the soil and to be incorporated with it when culture is resumed among the plants. Sawdust, where it can be obtained, is a very nice mulching material, easily applied and easily retained, but, on some soils at least, it renders their texture too compact by lying long on the surface, and on others of a dry and gravelly nature it furnishes too much matter to act as a mechanical divisor of the soils, for it remains a long time without undergoing decomposition, unless treated with lime. For heavy soils it is more appropriate, and in such chip dirt, or the scrapings of the wood-pile, in a partially decomposed state, furnishes an excellent mulching material, but it is not an elegant application, nor does it protect the fruit so well as those substances already mentioned. Those who have access to the great wood-sheds of our railways can obtain an unlimited supply of this kind of mulch, which they would do well to secure and compost with quicklime as a valuable application, particularly to clay soils that have been long in cultivation.

Tan-bark is another form of mulching material, and a very analogous one, which has met with great favor, and has been very highly recommended by most writers upon strawberry culture. Its merits are the lightness with which it rests upon the soil; the perfect manner in which it excludes frost in any moderate

degree of cold; the persistence with which it retains moisture, preventing evaporation; the complete shielding it provides against the sun's scorching rays, which it readily absorbs, warming the ground in spring; and, as claimed by some, its value as a special or chemical manure, for it contains tannic acid ready formed for the strawberry plant. Whether the plants take it up as tannic acid, in preference to manufacturing their own acid in their own way, in their own laboratory, from the raw material, just as the oak trees made it in the cells of their bark, is a question which is more easily asked than answered; but it is probable that, could we obtain a direct response from the Fragaria family, they would claim abundant powers to produce the tannin for their own constituents from the soil and air in which they grow.

All thorough mulching with any of these materials, it will be understood, can be applied only to limited plantations. They are applicable to gardens rather than to fields, and will be used by the amateur and the prize cultivator, rather than by the market gardener and large strawberry grower; unless we except the rough mulching which is done in the strawberry fields, by the mowing of the weeds, that are always left to rot upon the ground where they fall, and among which the drifting autumn leaves collect and make a very good mulch.

LOOSE EARTH.

Some modern disciples of Jethro Gull, both practical agriculturists and horticulturists, recommend and use high culture, by constantly keeping the soil loose and mellow, and recommend this as the best possible mulch. For the summer indications that require mulching, there can be no doubt that this is one of the very best means of meeting them, and though inapplicable in winter, the plants that have been mulched with a deeply and thoroughly pulverized soil during the whole season will be in such a condition as to be able to resist the freezing as well as the thawing of winter.

PLANTING

is a very important part of strawberry culture, and may be done at almost any season of the year when the ground is neither frozen solid, nor arid with the heats and droughts of summer. Most writers recommend the August or September plantings, but our practical men, who make large plantations for the market, prefer the spring. For this they have many good reasons, among which may be mentioned the greater certainty of the plants living and the very much greater economy, both of the plants themselves and of the labor of setting them, because they will have the whole season to spread by their runners, and need not be set so thickly. The strawberry farmers generally select a piece of newly-cleared land, where the forest has been so dense that no grasses have yet shown themselves. A piece of new prairie ground is found to answer as well the next season after breaking up. The soil is ploughed and marked off in one direction as for corn. Corn is often planted, but thinly, so as to make but half a crop, which will shade the strawberries and help pay for the occupancy of the ground; sugar corn or the low-growing varieties are preferred. The strawberry plants are set in the same rows with the corn, and may be cultivated with it. They may be placed between every two hills of corn, say two and a half to three feet apart, and the runners from most varieties will cover the ground sufficiently during the first summer to insure a good crop the next year. The second season they can receive very little cultivation, but may require the use of the hoe in the spring to thin them out where too thick, and to destroy a few prominent weeds, but in this kind of rough field culture very little attention is bestowed upon their cultivation; that is left to the amateur in the garden, and his duties, cares, and labors will be pointed out in detail in another section. The object now is to prepare for the *million*.

After harvesting the first crop, which should be sufficiently abundant to have paid all the expenses incurred, very little is generally done except to go over the field with a scythe and cut all obtruding weeds. Where it is possible, a light turning plough may be used to great advantage, immediately after the harvest, to gather or ridge two furrows between the rows, and in the course of a fortnight this ridge should be stirred and levelled by using a double-shovel plough or other cultivator, which will leave a fresh surface of mellow soil for the runners to form new plants upon. Some practice this ridging between the rows early in the spring, which is a good plan, as it marks the rows while it cultivates the plants. This culture is kept up by the double-shovel about the period of ripening, and the culture may be repeated after the harvest in this case also. Toward the close of summer the weeds should be cut as before advised for the first season.

The next year the second crop will be harvested, and it should be a good one if reasonable care has been exercised during the previous season to prevent the crowding of the plants and the introduction of blue grass, white clover, and other weeds. Much will depend upon the varieties of strawberries planted—some produce more runners than others; and while they cover the ground and smother the weeds, they also crowd and injure one another. When this is the case they must be thinned. Good culture, so important and necessary to the production of the best crops, is, manifestly, out of the question; but an attempt may be made by chopping out the surplus plants with a sharp hoe. This may be more cheaply effected with horse power, by using a very sharp scuffler or shallow horse-hoe; but the method generally pursued in large fields is to drag the ground with a heavy harrow when very loose from rain, or when the frost is coming out of the soil. This looks like a barbarous method of culture, and it is so, but it is generally followed by a very fine crop of excellent fruit.

Another method of treating an old and overgrown plantation is to list the ground with the plough, ridging two furrows together before harrowing. This gives a new fresh surface for the young runners to occupy, and by repeating the process the next year upon the intermediate strips the whole plantation is renewed every alternate year, and the crop may be continued for many successive seasons. The old plants are exhausted by their fruitage, but still more by the production of runners, and they soon cease to be fruitful; hence the necessity of renewing the plantation, or of suppressing the runners, which latter is preferred in *garden culture*, and will be recommended under that head.

DURATION.

If properly managed, a plantation of strawberries may be kept in a fruitful condition for several years. One cultivator claims that he has had them continue to do well for ten years; but this is not often the case in the common mode of field culture, where three good crops is the maximum with most farmers, who, with their rude treatment, find the old plants soon exhausted by the production of runners, the young plants poorly developed on account of their being too much crowded, and the whole very soon overrun, and often overcome entirely by the advent of blue grass, white clover, and weeds. Hardy, indeed, and vigorous must be that strawberry plant which can prove victorious in such an unequal struggle.

When the strawberry field has become overgrown with grass it may be given up to pasture, or the plantations may be renewed by a complete preparation of the soil by deep ploughing, thorough harrowing, and again planting with a new stock; but it is better to cultivate one year in corn or potatoes, and afterwards to set out the strawberries.

GARDEN CULTURE.

Let us now turn to the consideration of the more thorough methods of producing fine crops of this delicious fruit—methods which are better adapted to the garden and to the small plantation of the amateur. The ground should have been well selected and thoroughly prepared as above suggested. We have now a choice whether to plant in beds, or in hills, or in single rows. The former should not be more than three feet wide, with alleys between them of two feet in width. These beds may contain three rows, with the plants one foot apart each way, so that they may be easily reached from the paths when the fruit is to be gathered. If hills are preferred, the plants should be set at equal distances of eighteen inches each way. If you should prefer rows, these should be from two to three feet wide, and the plants set from twelve to eighteen inches apart. This last method will readily admit the horse and cultivator between the rows, and is therefore more economical than such plans as require everything to be done by hand labor. The spring is, on many accounts, the best season for planting; and if care be exercised, and the plants have to be removed from one bed to another without transportation from a distance, they may be so carefully re-set as to produce a partial crop the first season. Others prefer to take the young runners in their first summer, and set them out for the new plantations. These may be nicely rooted as they form by placing them on the surface of small flower-pots that have been filled with good soil. This is some trouble; but such plants may be easily transported without injury, and may be transplanted with the greatest facility, and with a certainty of success. In selecting plants from the open ground the old stocks should be rejected; the strongest and most healthy runners should be carefully taken up with good roots. These should be at once puddled in mud of a creamy consistence to prevent evaporation and drying. They may be at once set in their new stations, or they may be packed, if for transportation, in small bundles, each to contain twenty-five, not more, and surrounded with moss; or, if not wanted immediately, they may be laid upon a cellar floor and lightly covered from the air. If left in this situation one or two days they will begin to emit new roots, and are then in a very good condition for setting out.

In planting the strawberry the great mistake, and one which is frequently committed, is setting them too deeply. The crown of the plant should be *upon*, not *below*, the surface. In other words, the roots only, and not the plant, should be set in the ground. Some force should be exerted to secure these fibres firmly. After spreading them in the mellow earth the soil should be firmly packed about them, and they should be so fast in the ground that they cannot be pulled out by the thumb and finger applied to a leaf, but the leaflet should break under the tension before the roots have been stirred. After planting they may be well watered, but remember that a little water is injurious. They may also be shaded by a large leaf or a piece of board or shingle if the sun shines clear and hot; this will not be necessary in showery weather, nor if the runners have been struck in thumb-pots, from which they are to be taken with the ball of earth, and set loosely in the new plantation. The next process is to rake or hoe the whole surface lightly. The potato rake is the best implement for this purpose, and then the mulching material may be applied to this loose surface. If not mulched, the rake should be used frequently, so as to keep the soil open and mellow. This culture should be shallow, and is best done by hand, though, when the plants have begun to grow, the horse-hoe may be used to advantage, and with great economy, when the plantation has been made in rows or in hills; and in the latter case the cultivation may be in both directions or across.

When the plants begin to grow in the spring of the year, or after spring

planting, the runners will soon make their appearance. These offshoots will exhaust the plants, and must be immediately removed by pinching, pulling, or cutting them away as fast as they appear. This is a serious labor, but a very important operation in this kind of culture, for we desire to strengthen the original plants, or stools, as they are called; and when the runners are removed these become stiff, stocky, and branched, having many centres or crowns to furnish an abundance of strong trusses of flowers and fruit. Some varieties will soon have stools of ten or twelve inches diameter in suitable soils, and under good cultivation, and from such we may expect the heaviest crops of the largest berries.

When mulching is used it should be applied in the autumn for a winter protection, as stated above; if of straw, this is left to protect the fruit, but must be removed after the berries are harvested, when the ground is to be thoroughly stirred with the cultivator, or if by hand labor, with the spade or hoe, and the surface is to be kept well cultivated during the season, so as to strengthen the plants, while at the same time all runners are to be removed as fast as they appear. Other mulching of short material will offer little obstruction to cultivation, and may be worked into the soil or left upon the surface during the summer to keep it shaded and moist, in which case no culture is applied.

IRRIGATION

with water led among the plants at the will of the cultivator has been found to produce excellent effects; but Mr. Peabody, who claims to have rendered the strawberry a perpetual bearer, attributes his success to the application of "water in showers," combined with the absence of stimulating manures, and a light soil well supplied with vegetable matter in the form of leaf-mould. He says that flowing water does not produce the same effects.

FORCING.

This means the preparation and treatment of plants in such a manner as to produce their fruit early in the season, in anticipation of the regular crop, to gratify the palate of the epicure, and to secure for the cultivator the benefits of the high prices of the early market. Gardeners who have a liberal supply of glass, either in frames or in grape-houses, may pursue forcing with advantage; it is, however, a plan rather for the few than for the million.

Vigorous runners are struck in pots, as above indicated; after having been separated from the mother plants they are collected and slightly shaded and well watered, so as to make them grow vigorously; so soon as the roots fill the pot they are shifted to those of a larger size, using good soil. The same care and watering is continued until they are well established, when the watering is gradually suspended toward autumn, and the pots are thrown upon their sides, but protected from severe frosts, so that the plant shall go to rest completely. About mid-winter they are righted and removed to the frame or house, cleaned off and gradually started into growth, and then watered freely. A simple hot-bed frame will answer, the pots being plunged in old tan-bark or loose soil, and a lining of manure may be set around the frame, or the sun's heat alone may be used—according to the rapidity with which it is desired to conduct the forcing. There is with strawberries, as with other plants that are subjected to this process of anticipating their natural season, a great difference in the varieties—some will force much better than others. In this artificial mode of culture care must be had to provide a sufficient number of staminiferous plants, for a frame or house filled with the pistillate varieties alone could not produce any fruit. When in blossom it will be well to admit air, and at the same time insects, to aid in the process of impregnation. Some gardeners agitate the trusses of flowers by passing the hand over the blooms for the same purpose.

A recent visit of Mr. Wray to this country, where he has seen the American mode of cultivating the strawberry founded upon scientific principles, has inaugurated a new era in the culture of this fruit in England; for he went back and told his friends what he had seen and learned, and, that though their potted plants produced a few fine specimens which would command two pence apiece, still they did not know what *productive* meant when applied to the strawberry. The intelligence appears to have fallen like a bombshell into the horticultural camp, and has excited the ire of the *Gardener's Chronicle*, its editor, and all of its supporters.

PRODUCE AND PROFITS.

The productiveness of the strawberry is immense, and the consumption of them is in proportion, and yet they bring a good price. The export demand from some cities helps to keep up the price. Mr. Pardee estimates the sales in the four cities of Boston, New York, Philadelphia, and Cincinnati, at 93,000 bushels per annum—it would be nearer to the round number of one hundred thousand. A single train has taken into New York 893 bushels, and the aggregate amount of sales in that city may be estimated at $200,000.

The average crop is not so large per acre as it should be, owing to the rough kind of culture, but we have accounts of crops of from one hundred bushels to two hundred and fifty bushels per acre. Eight hundred dollars have been realized from an acre. Mr. Knox, of Pittsburg, has been very successful as a large cultivator of strawberries upon the most thorough mode of cultivation; he admits that his plan costs two hundred dollars per acre, but claims a proportionately large yield and return of profit.

This article should not be closed without a reference to Mr. Knox, who has extensively and practically carried out the recommendations of growing the plants separately and without runners. He may be said to have wrought a revolution in the culture of this fruit. Mr. Thomson gives the following account of his strawberry grounds in the *Gardener's Monthly*, for November, 1861, page 333:

"He has been called the 'Strawberry King;' and if unquestionable pre-eminence in this branch of fruit culture can entitle a person to the appellation, it is justly bestowed. He has fifty acres in strawberries. * * * During the past season the hands employed in picking and sending fruit to market numbered, at times, as many as three hundred a day, and the berries were sent in large quantities to New York, Philadelphia, Buffalo, Chicago, Detroit, and most of the other cities of the north and west, some even to Canada. In consequence of the size and handsome appearance of the fruit, (the results of thorough culture of choice varieties,) it brought, in most cases, fully double the price obtained for such as is ordinarily to be found in our city markets. * * *

"For fruiting, all the vines are cultivated in rows two and a half feet apart. * * * The vines are kept free from runners, which are removed by hand as they appear; the effect of which is extraordinary vigor of growth, and the formation of numerous and prominent crowns, which will throw up an abundance of strong fruit stalks next season. The ground between the rows is kept perfectly clear of weeds by hoe and hand culture; and the latter part of November the entire beds are covered with a layer of straw, which protects the plants during the winter, is removed from the plants in the spring, and suffered to remain between them during the summer, acting as a mulch, keeping the ground moist, protecting the fruit from dirt, checking the growth of weeds, and eventually, by decaying, afford nourishment to the soil. * * * *

"The mode of culture pursued on this farm is necessarily expensive, but experience has demonstrated that it pays better than a less expensive system; its policy, even in an economic point of view, is established."

At a meeting of the Brooklyn (New York) Horticultural Society, Mr. Knox said:*

"The soil I prefer is a light clay limestone. I stir the ground, for a crop of two or three years, not to a great depth—eight to ten inches. For producing strawberries ten or more years, stir from twenty inches to two feet, after drainage. I do it with an ordinary plough and a lifter, with oxen. Plant in rows two and a half feet apart, and ten inches apart in the rows. I raise no fruit the first year, but take off the fruit stems and all runners as fast as they appear. For a few years I stirred the soil with a strawberry cultivator, but now do not disturb the soil at all; the whole ground becomes a net-work of fibrous roots. As a protection in the fall, I prefer rye straw threshed with a flail, and attach great importance to this covering; frost will destroy much embryo fruit if not protected. It acts as a mulch, and keeps moisture in the ground. I have discarded every implement except the hoe, and use that only for weeds.

"I speak with considerable caution about varieties. Hovey's Seedling is very valuable. It does well at Boston and at Cleveland, but does not do well with me, with all my care. Some varieties deteriorate. Buist's Prize has run out, and is nearly discarded by growers at Pittsburg. We have to suit different tastes—some like tart and others like sweet. It is important to lengthen the season. This is ordinarily three weeks; but by selecting different kinds we can extend it to five weeks. Baltimore Scarlet, Jenny Lind, and Burr's New Pine are good early strawberries; Trollope's Victoria, Kitley's Goliath, Nimrod, and Buist's Prize are good later ones. For medium season: Brighton Pine, Boston Pine, McAvoy's Superior, Scott's Seedling, Moyamensing, Downer's Prolific, Filmore, Golden Seeded, British Queen, Vicomptesse Hericort de Thury, Wilson's Albany, and last, but not least, the Triomphe de Gaud. Wilson's Albany is certainly a very valuable variety, although our Boston friends condemn it; it improves by years, and is preferred by many. But the strawberry of all strawberries—the one I would plant, if confined to one, on ten feet or one hundred acres—the strawberry for the eye, the palate, or the pocket, is the Triomphe de Gaud. It produces an abundant crop—not so much as the Wilson, but an acre of the Triomphe is more profitable than an acre of the Wilson. Nearly all the Triomphe de Gaud are uniformly large, and they remain so to the end of the season. It is the most beautiful of all strawberries, and would draw attention from all others. It throws the Wilson into the shade. It carries well. I have sent them to Erie, Cleveland, Cincinnati, Philadelphia, Buffalo, and New York. * * * For marketing, my experience is this: Produce a good berry, handle it well, bring it before the people in a handsome and attractive condition, and they will pay for it; and it will be a long time before the market can be overstocked with fine fruit. In gathering the fruit, pinch off the berry with the stem on; don't pull them.

"The Wilson may be made to produce from five to six hundred bushels per acre. We can average three hundred bushels to the acre with the best varieties properly cultivated. By expending one hundred dollars I can make one acre pay better than five acres managed in the old way. I care nothing for old plans as long as I can invest my money at one hundred per cent., and I have good reason to know that mine pays that."

The reader of the above must bear in mind that the enormous crops of Mr. Knox are the result of high culture, and with the persistent removal of all the runners. The plants are thus forced into the production of fruit.

It was not the intention of the writer of this essay to have said anything about selection of varieties; but as the preceding quotation has introduced several sorts which, under the common modes of field culture, have not proved to be profitable, it may be well to mention some that have proved themselves able to compete with weeds and blue grass and neglect, and still to bear most satisfactory

* *Vide* Horticulturist, vol. 17, page 100.

crops of fine berries. The Extra Red (pistillate) is one of this character—vigorous, hardy, prolific, and very beautiful. The Neck Pine, (also a pistillate,) which Mr. Prince claims to be an Illinois species, is another variety which should be named as hardy and very productive. These, with some staminiferous variety, like the Iowa, the Wilson, and the Longworth Prolific, are the sorts for the million. They are able to take care of themselves; and though they will pay for proper treatment, they will even bear neglect.

THE BOTANICAL CLASSIFICATION.

In the systematic arrangement of the different strawberries we find some diversity among different authors. Loudon, in his Encyclopædia, which is generally very full, gives the following list of nine species:

1. Fragaria vesca, (*Willdenow,*) Wood strawberry—Britain.
2. Fragaria monophylla, (*Willd.,*) One-leaved strawberry.
3. Fragaria collina, (*Willd.,*) Green Pine strawberry—Germany.
4. Fragaria Canadensis, (*Michaux,*) Canadian strawberry—North America.
5. Fragaria elatior, (*Willd.,*) Hautboy strawberry—Bohemia.
6. Fragaria Virginiana, (*Pursh.,*) Scarlet strawberry—North America. This has been two hundred years in cultivation.
7. Fragaria grandiflora, (*Willd.,*) Pine strawberry—Surinam.
8. Fragaria Chilensis, (*Willd.,*) Chili strawberry—South America.
9. Fragaria Indica, yellow-flowered strawberry—India.

Don, an elaborate and oft-quoted writer on gardening, seems to have been more prolific in species of strawberries, besides which he gives us the varieties so far as known to him. His list is subjoined:

1. Fragaria vesca, (*Linnæus,*) Alpine and Wood strawberry—Europe.
2. Fragaria calycina, (*Lois*)—France. Syn., F. vesca grandiflora, (*De Candolle.*)
3. Fragaria collina, (*Ehrhart,*) Green strawberry—Germany, Switzerland.
4. Fragaria platanoides—North America. This, he says, has its flowers dicœcious, from abortion.
5. Fragaria Majufea, (*Duchesne,*) Majufe strawberry—France.
6. Fragaria breslingea, (*Duchesne*)—France. Var. *abortiva* is almost sterile.
7. Fragaria elatior, (*Ehrh.,*) Hautboy strawberry—England and North America. (?) One variety, he says, is dicœcious, from abortion.
8. Fragaria Virginiana, (*Willd., Ehrh.,*) Scarlet strawberry—North America. Dicœcious, from abortion.
9. Fragaria grandiflora, (*Ehrh.,*) Pine strawberry—Surinam. Always dicœcious, from abortion.
10. Fragaria Chilensis, (*Ehrh.*)—Chili, South America, Patagonia. Always dicœcious, from abortion.
11. Fragaria Bonariensis—Buenos Ayres. Like No. 9.
12. Fragaria Canadensis, (*Mich.*)—North America.
13. Fragaria Sundiaca, (*Blumenbach*)—Sunda straits, Java.
14. Fragaria monophylla, (*Willd.,*) Simple-leaved strawberry—Europe.

Our own botanist, Asa Gray, describes two species in this country:

1. Fragaria Virginiana, (*Ehrh.,*) which are characterized by having the achenia (seeds) imbedded or sunken.

2. Fragaria vesca, (*Linnæus,*) which has the achenia superficial. This he marks as introduced from Europe. I have never met it growing wild.

William R. Prince, of Long Island, in a recent article in the Horticulturist, attempts to establish two other species, natives of our country, which he calls F. Iowensis and Illinoensis; but it is very doubtful whether he will be able to establish his species by any of the rules for such cases made and provided.

The distinguished pomologist, T. H. Knight, of England, on the contrary, seems disposed to reduce the number of species, and that by one of the most common and most generally accepted rules of classification, that of crossing without the production of a *male*. Thus he considers Fr. Virginiana, grandiflora, and Chilensis, Nos. 8, 9, and 10, of Don's list, to be all one species, because they may be crossed, and the seeds are not rendered abortive. The observations of gardeners go to prove that many of our cultivated strawberries are of mixed races and probably crosses of different species, so that it is difficult to make out a classification strictly according to the species described.

SEXUAL CHARACTERS.

Mr. P. Barry, writing about the sexual characters of the strawberry in the Horticulturist for 1854, August number, says: "In Europe this distinction is not observed to any extent, and all the English and continental varieties, as far as we know, are hermaphrodite. In this country very many of them fail from an imperfect development of the pistils, and are consequently barren, owing, doubtless, to the effects of climate and culture."

In August of the same year Mr. Longworth wrote to Mr. Pardee that he had "sent some of our seedlings to the president of the London Horticultural Society. Among them were some pistillates. The president replied that he was not aware that there were plants that would not bear fruit without impregnation, and suggested that the failure was owing to frost."

The dicœcious character of some strawberries has been considered an American distinction, and our American designation of strawberries by the terms *pistillate* and *staminate*, indicative of their peculiarities of inflorescence, is a matter of great practical importance, only introduced into general use in this country; indeed, it has been rather ridiculed by many of the best gardeners we have from England.

It is not now pretended that irregularities of inflorescence are peculiar to this country, since a reference to the lists of species will show that in Don's list the species numbered 4, 6, 7, 8, 9, and 10, are described as being "dicœcious, from abortion." This expression is not altogether satisfactory, because not sufficiently precise, and yet we may infer, from the following extract, in which he refers to the observations of Mr. Keen, that some plants had abortive stamens, (our pistillates,) and others had their pistils more or less defective, so as to be poor bearers, the latter corresponding to those we commonly call staminates or staminiferous, the true staminates, those almost absolutely sterile, being represented by the variety *Abortiva* of Duchesne's species breslingea, No. 6 of Don's list. The following is a condensed quotation from Don: "Mr. Keen says there are many sorts of *Hautboy;* one has male and female organs in the same blossom, and bears freely. * * * He prefers that which has *male* in one blossom and *female* in another; as though he had been familiar with that rare form of inflorescence, where both kinds of flowers are produced by one plant, and sometimes appearing on a separate stem, generally on the same truss—a monœcious variety; but this does not seem to be justified by what follows, for he says: 'Care must be taken not to have too many *male plants*, [dicœcious,] for, as they bear no fruit, they are apt to make more runners than the females,' [*pistillates.*] He recommends planting one male to ten female plants." Mr. Keen appears to have made this discovery in 1809, when he had a bed of plants that he had selected, all females, and he was disappointed in his crop. Suspecting his error, he obtained some male blossoms, which he placed in a bottle on the bed of female Hautboy, which soon set fruit near the bottle. These valuable observations appear to have attracted no attention, and the subject has been but little understood by the most intelligent writers on botany and horticulture, but since 1825 it has been kept constantly before the public, on account of its great prac-

tical value, by N. Longworth, esq., of Cincinnati, Ohio, whose attention was directed to it by the son of a very successful strawberry grower who had emigrated from Philadelphia, where he had previously practiced upon the same principles. Mr. Longworth, with laudable pertinacity, reiterated the facts and repeatedly directed public attention to them, so that the sexuality of the strawberry came to be known as the Cincinnati theory, or as Longworth's theory. The results upon our market very soon became a matter of history; the quarts and gallons were multiplied so as to be measured by hundreds of bushels as a daily supply, and the price was proportionately reduced from fifty cents to ten cents per quart, so that this healthful and delicious fruit was reduced, from being a luxury for a limited number, to become an article of universal consumption by all classes of our population; and all this has been owing to the persevering repetition of the facts by a single individual. Mr. Longworth laid his views before our Horticultural Society, who referred the matter to a committee for thorough investigation, the results of which duly appeared in a printed report, from which, and from later reports of the same society, the following extracts are produced.

In the first report, 1846, these positions were taken:

1. Strawberry plants raised from seed are liable to run into varieties, and a peculiarity of these is the irregularity of the reproductive or sexual organs.

2. A few varieties have the flowers perfect, and present the stamens and pistils both fully developed in each flower. Such flowers may produce a good crop of medium-sized fruit.

3. The best varieties have the female organs fully developed, and the male organs so imperfect that they appear to be wanting. These are called pistillates, and need impregnation.

4. Other varieties are perfect in the male organs, with the pistils imperfect. Such plants will produce an imperfect crop, though some flowers may have perfect pistils and produce berries of large size; but under the most favorable circumstances they will fail to mature an abundant crop of fruit.

5. There are other plants so defective in the pistils as to be completely sterile, and fail to produce fruit, either in their native state or under the most careful cultivation.

These varieties do not change their character so as to be transformed from one class to another, but continue their original distinction in the runners, and remain the same under all circumstance of cultivation.

THE STRAWBERRY—(FRAGARIA:)

ITS SPECIES, NATIVE LOCALITIES, AND THEIR NORMAL SEXUAL CHARACTER.

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THE recent publication in a London horticultural periodical of an article written by Leonard Wray, who has recently visited this country, in which he explains "*The scientific culture of the strawberry in America*," has awakened public attention there to this highly interesting subject. As very erroneous views have existed both there and here, I presume a short paper will be acceptable to the public.

EUROPE presents us with three species of strawberries which, in their normal state, all produce fruit of small size. Two of these species have hermaphrodite flowers, and the third (Fragaria elatior) comprises male, female, and hermaphrodite flowers. These European species are:

Fragaria vesca—The Wood and Alpine strawberry.

Fragaria collina—Green Pineapple strawberry.

Fragaria elatior—Hautbois strawberry.

Fragaria monophylla, of Linnæus, does not exist as a species, it being a variety of F. vesca.

Fragaria sterilis, of Linnæus, has proved to be Comarum fragaroides.

NOTE.—Both Linnæus and Miller supposed, and so stated, that the F. elatior (Hautbois) was obtained from America; an error that can scarcely be accounted for.

ASIA presents us with one hermaphrodite species:

Fragaria Indica, producing yellow blossoms, and whose fruit is not edible.

SOUTH AMERICA presents us with two species, both of which have large foliage and flowers, and fruit of remarkable size, and which comprise, in their normal state, both staminate and hermaphrodite varieties. These are:

Fragaria grandiflora—Pine strawberry.

Fragaria Chilensis—Chili strawberry.

(The *Fragaria Bonariensis*, of Loudon, is only a synonym of *F. grandiflora*.)

NORTH AMERICA presents us with six species very distinct in character from all the European and South American species, and producing fruit varying from a medium to a large size.

These species each present, in their normal state, plants of two characters: 1st, hermaphrodite, or bi-sexual; and 2d, pistillate, or female. Of the hermaphrodite section there are two divisions: the one combining the stamens and pistils in each flower; and the other producing some peduncles of entirely bi-sexual, and others of entirely pistillate flowers.

These American species are:

Fragaria Virginiana vel Canadensis—Scarlet strawberry.

Fragaria Hudsonica—Hudson's Bay strawberry.

Fragaria Iowensis—Iowa strawberry.

Fragaria Illinoiensis—Illinois strawberry.

Fragaria lucida—California strawberry.

F. sericea, of Douglas,
F. Chilensis, of Torrey and Grey, } Oregon strawberry.

(*The Fragaria Caroliniensis*, of Loudon, has no distinct existence, but is merely a synonym of *F. grandiflora*.)

(The *Fragaria Caroliniana*, of Duchesne and Poiteau, is also a synonym of *F. grandiflora*.)

The European species being hermaphrodite, and but one of the North American species being known to Europeans in the time of Linnæus, he supposed that all the species of the genus Fragaria were of the same character, and consequently placed them under the class and order *Icosandria polygynia*, comprising the stamens and pistils in the same flower. The two South American species, which comprise staminate and hermaphrodite varieties, and whose large fruit caused them to be preferred in Europe, are the only species from which the numerous seedling varieties they now possess have been originated; and as but one sexual variety of the *Chilensis* was carried to Europe, there have been only a few hybrids grown therefrom. All the others are seedlings of the *F. grandiflora*, and they are very numerous throughout Europe. These seminal varieties have retained their normal parental character, as this species does not admix even with its own congener of South America, (F. Chilensis,) as but one sex of that species had been obtained.

This primal character of the Pine family comprising staminates and hermaphrodites has always been sustained, but the adoption in Europe of an unnatural system based on the extermination of all the staminates, (males,) has resulted in filling the gardens of Europe exclusively with varieties of the hermaphrodite character; and, as preference has been there given to these large white-fleshed varieties over the scarlet-fleshed varieties of the *Fragaria Virginiana*, it has caused an almost total exclusion from their gardens of all the North American species and varieties. The prejudice thus generated has prevented the introduction into Europe of the productive American pistillate, or female varieties, as well as of our hermaphrodites, comprising the numerous large hybridized varieties which constitute such remarkable improvements over the few North American kinds they already possess, both in the size and flavor of their fruit, in the far greater hardihood of the plants suitable to the most northern climates, and especially in their great productiveness, the latter quality arising from their sexual physical capacities, and from the "scientific culture of the strawberry" in the combination of the sexes.

Europe, at the present time, possesses no female varieties except the pistillate *Hautbois*, which she exterminates, and the few pistillate varieties of *Virginiana*, mostly obtained from America two hundred years ago, and two only of our estimable pistillate varieties, which have been recently introduced there; this deficiency having resulted from her fatuity in ignoring the rapid progress made in the strawberry culture in America during the last fifty years.

Black strawberries.—The varieties which are so called and classed as a distinct species or family in the London society's transactions, are not actually so, but are merely very dark-colored varieties of the *F. Virginiana*, or hybrids. No such distinctive division is made by the French and Belgians. The Downton is a seedling of *F. Virginiana*, and others may be hybrids, such as Black Prince, Hovey, &c.

In Johnson's Dictionary of Gardening this section is distinguished as "*F. vesca nigella;*" but as *F. vesca* is European, and all the black strawberries are from American species, the author could not have been very conversant with the subject.

Mr. T. A. Knight, when president of the London Horticultural Society, raised a large number of seedling strawberries, from which he selected about twenty varieties, which were described in the society's transactions, but these were grown from seeds injudiciously selected, without any proper regard to sexual hybridization, and it would seem that he was then, as Dr. Lindley has been since, ignorant that such sexual distinctions existed, although he had seven pistillate varieties in the garden over which he presided. The varieties produced by him have, in consequence of their inferiority, been long since abandoned. Mr. Knight considered the *F. grandiflora* or Pine, the *Chilensis* or Chili, and the *Virginiana* or Scarlet, to be only varieties of one species, as all these (he says) may be made *to breed together indiscriminately*. This is a radical error. The first two species will blend with each other, although they are very distinct, but these two differ so entirely from the *Virginiana* that they never commingle therewith.

It is plainly apparent that in Europe this subject of sexuality has been almost entirely overlooked by the mass, and that investigation has been neglected by the professedly scientific, and discouraged by the prolonged assumptions of Dr. Lindley and others, that the "science" of the otherwise "cute" Americans was mere "theory and assertion," which simply required a little English "practice and common sense" to regulate it. Thus they have, during the whole period of forty-four years since the establishment of the London Horticultural Society's garden, remained in the ignorance of "intellectual exclusiveness," from which Mr. Wray's account of what he saw in America has at last awakened them.

Undoubtedly the publication by Mr. Wray of the "Scientific culture of the strawberry," resulting from his recent visit to our American gardens, will effect quite a change in the European method of culture, so that it will henceforth be based on those scientific principles long practiced in this country, and which were announced by my father, William Prince, and myself, in various horticultural periodicals, and published in our "Treatise on Horticulture" in 1828, and which have been assumed by Mr. Longworth and others throughout our country, until they have become the recognized basis of all American strawberry plantations.

So indispensable is this sexual combination to the production of abundant crops in all the American varieties, and in the Pine and Hautbois varieties cultivated in Europe, that it may well be doubted whether any person in England has yet realized what constitutes a full crop of strawberries. Attention to sexual distinctions being indispensable in a scientific view, it is equally demanded in every country and climate where strawberries are grown that possess these characteristic distinctions.

There should be no confused application of the sexual terms *staminate* and *hermaphrodite*, as the plants of these sexual divisions are entirely distinct; and while there are some species or families that combine both of these traits, there are others that possess but one, to the entire exclusion of the other; and a lack of discrimination will consequently produce confusion. Nor should the term "sterile" be ever used in reference to staminates or pistillates, it being inapplicable to either.

It may here be cited as a singular fact, that of the eleven edible species of the strawberry, there is but one which is positively known to combine all the three variations of staminate, hermaphrodite, and pistillate; although European writers, and some of our own, have run into the idea that the seeds of any one species would produce plants of all the three sexual divisions, and some have even declared that there was such confusion and vacillation in the sexuality, not only of seedlings, but of the actually existing varieties, that no reliance could be based on these distinctions as a reliable test for distinguishing species and varieties. Such views, however, are adverse to the facts. No such variations of character ever occur, but Nature sustains these normal distinctions as permanent and eternal, the vacillations finding existence only in the brains of such theorists.

Although it is a truism that the differences between the humid and cool climate of England and our dry and hot atmosphere cause the best educated English gardeners who migrate here to commit great absurdities, yet these climatic variations have no more connexion with the sexuality of strawberries, nor with the results of that sexuality in the productiveness of the crop, than they would have on two crops grown side by side—the one on dry soil, and the other subjected to irrigation. *Sexuality is Nature's own fact;* the success and extent of the crop are the result of art and culture. The incontrovertible truth thus stands forth that the exercise of science in regard to the existing sexuality is not necessarily variable by climate, but is quite as important in one country as in another.

The chimerical idea of a transmutation of sexes by any variations of climate or circumstances is antagonistic to that order of Nature which can never be varied or contravened any more in the humblest plant than in the largest animal, or in the movements of the spheres.

> "From Nature's chain whatever link you strike,
> Tenth or ten-thousandth, breaks the chain alike."

As climate—cold or hot, dry or humid—can in nowise affect the sexuality of any plant more than of any animal, the assertion made by a quondam observer, which has been made in print, that the Alpine varieties of strawberries, which

have perfect flowers (hermaphrodite) in the regions of perpetual snow, when removed to the climates of lower parallels produce pistillates and staminates as seedlings, *has no foundation in truth.* As the plants growing in the alpine regions are all of the *Fragaria vesca* and *F. collina* species, I now put the question to every cultivator whether he has ever seen one single variation, as alleged, in all the seedlings that have ever been produced from those two species. No such variation has ever occurred, and the assertion is in direct contradiction to Dr. Lindley, who says he has never seen any other than hermaphrodite plants, except of the hautbois, (*F. elatior.*) It is also controverted by the fact that it is universally recommended that the wood and alpine varieties be propagated from seeds, their sexual organs being always perfect; and this course is specially urged by Keen, in the London Horticultural Transactions, and in the "Bon Jardinier," they having been grown in France for centuries without the least variation.

All the esteemed European seedling varieties now cultivated in England, France, and Belgium are hermaphrodites, and Mr. Wray states that "these are so imperfectly developed in their organs they seldom produce other than a very scanty cross of inferior and imperfect berries." "That the object of the high-priced grower is attained if he only has a few large-sized berries on each plant; but that if these plants were placed in an open field, deprived of hand-glasses, artificial impregnation, and unremitting watchfulness, they would be dead failures, and for a general crop quite unsuitable."

It is admitted on all hands that the principal strawberries in England are treated as tender exotics, and Mr. Wray asks, "Why is it so pampered, swathed, and swaddled, and its hardy character so completely ignored?" In England the fine varieties of strawberries are so expensively grown that they only reach the tables of the wealthy classes, whereas in America they are chiefly grown for the million. Mr. Wray also remarks that "so hardy a plant should certainly appertain more to open field culture than to the elaborate and expensive culture of the garden." The reason, he says, is "because science has not been applied to its culture," and hence "the supply is totally inadequate to the demand."

There are points of consideration other than the sexual question which European writers and cultivators have hitherto lost sight of, and that even Mr. Wray does not seem to realize, which hold a most important bearing on the success of the strawberry in open field culture in England; but as these appertain more particularly to that special point, I propose to consider them in a future paper specially devoted to strawberry culture.

Here strawberries are grown, without any special care, in vast fields of ten to fifty acres, without any covering or protection. The idea of treating our estimable varieties as tender exotics, when their parentage is traceable to Labrador and to the Arctic regions on the Atlantic, and to Oregon and Vancouver's island, and beyond Lake Attabasca, on the western side of the continent, is an absurdity which no American has been guilty of. Mr. Wray speaks of 5,000 quarts being grown to an acre in Cincinnati; but on many plantations, there and elsewhere, 200 bushels (6,400 quarts) are not considered an extraordinary crop, and in frequent instances it is claimed that the crop amounts to 250 bushels, or 8,000 quarts, per acre. It is shown by our present statistics that one strawberry grower sent to market 6,000 quarts a day, his crop for the year amounting to $6,200. In statistics published in the New York *Times* the following statement is made: "The strawberry trade of New York is the largest of any one point in the world. It is estimated that 50,000 bushels are sold annually in New York, while about 12,000 bushels are sold in Philadelphia, 12,000 in Cincinnati, and 10,000 in Boston. During one week last season 400,000 baskets were received daily in New York. From one port in New Jersey, twenty-five miles distant from the city, there were received by steamboat, in a single day,

200,000 baskets. The largest receipt of strawberries in a single day, by railroad, was a load of 892 bushels, or 142,000 baskets, brought in by an evening train on the Erie railroad. New York city received last year, from all sources, not less than 8,000,000 baskets of strawberries; the value of these, at the wholesale price of 2½ cents the basket, was $200,000, for which the consumers probably paid double that sum. About 1,500 acres of choice land in the vicinity of New York are required to supply this market with strawberries. Some farmers cultivate 30 to 50 acres."

How great, then, the loss to Europe that they have failed to introduce our robust and productive American varieties! Not content, however, with ignoring our productive pistillate varieties, the European culturists have, with a singular lack of judgment, cast aside also the advantages which nature had presented to them, and adopted the custom of annihilating the indispensable staminate plants of the hautbois and pine families.

The large "white-fleshed varieties," as the pine family is termed in Europe, and which are there held in most esteem, have all been originated from seeds of the *F. grandiflora*, which comprises both male and hermaphrodite varieties, and it has there been particularly insisted that the hermaphrodites of this family possess both the male and female organs in perfection. It is true that the organs are always present, but the male organs of these hermaphrodites are deficient in pollen, whereby a combination with the staminate is rendered indispensable to a perfect crop. The assumption of the fatal error as to the perfection of the hermaphrodites culminated in the adoption everywhere in Europe of a system based on the destruction of all the male seedlings, and a practice thus fallacious—an utter perversion of nature—has been universally urged in England and elsewhere throughout Europe, and has resulted in the extermination of the male plants. It seems never to have occurred to their superficial minds that nature, always equally economical and provident, and ever compensatory, had not furnished these staminate or male varieties without a purpose, and that they were, therefore, essentially necessary to the ample results which nature had designed as to the crop.

> "Go, wiser thou! and in thy scale of sense
> Weigh thy opinions against Providence;
> Call imperfection what thou fanciest such,
> Say here he gives too little, there too much."

Although the hermaphrodite varieties combine the two sexual organs, yet normally but one of them is perfect and preponderates, and the other is defective; consequently, the combination of the male is required in the one case and of the female in the other to perfect a full crop. It would therefore seem that nature, in the vegetable as in the animal kingdom, is ever exercising her influence on the compensating principle, and that the means imparted are always in exact ratio to the result to be attained. And it must here be borne in mind that these sexual conditions are all normal or primeval, and consequently are permanent.

From the time of Linnæus and Jussieu to the present day we do not witness any sexual change whatever, and a standard that has remained unchanged from their day down to the present time, with no prospect of any future variation, may well be considered as permanently established.

When in any of the Fragaria species the male organs of the hermaphrodite are imperfect, nature, ever provident, furnishes the male or staminate plant to supply the deficiency. And when in any species the female organs in the hermaphrodite are defective, nature presents us with the pistillate or female variety. But when any species like the *F. vesca* and *F. collina*, and also the *Indica*, are perfect in both organs throughout all their varieties, nature, never wasting her resources, gives us none other than hermaphrodites.

These exterminated males are as necessary to make up the imperfection of the *male* organs in the European and South American hermaphrodites as the

female or pistillate varieties of North America are essential to compensate for the deficiency in the *female* development of our hermaphrodites. It is this perversion of nature, by the destruction of the male plants which she had furnished, that has rendered it necessary in the humid climate of England to have recourse to artificial culture by hand; and this attempt to improve on nature, while in reality waging a most unnatural war against her, has been the long continued cause of the miserable crops produced in England, where the flowers of many varieties are reduced by hand to four on each plant, and the plants have also to be specially nursed to insure the development of even this small product. The wanton destruction of the male plants, so necessary to efficient impregnation, is precisely similar to a man's cutting off both his natural arms in order that he might find use for artificial ones. The annihilation of the males of their own native hautbois is not only strenuously urged in Europe, but it is declared by their most intelligent (?) cultivators that it is to the existence of these "sterile" (males are not sterile) plants that the discredit and abandonment of its general culture is to be attributed, in consequence, as they say, of some people believing (as the Americans do) that it is necessary to combine the two sexual varieties to insure a good crop; and that by adopting this course the "sterile plants" (males) overrun the females, and thus the beds become nearly barren. I would suggest the adoption of our American practice of planting the sexes in distinct beds. I desire also to impress on European cultivators that it is this same unnatural destruction of the males that has reduced the crops of the hautbois, which were formerly abundant in a state of nature; and I urge the adoption of American science (as to sexuality) in their treatment, by which they can restore its former fertility. Thus by reversing their practice they will revolutionize the results.

The additional normal fact that the four great families—the *F. elatior*, (hautbois,) and *F. vesca*, (wood,) the *F. grandiflora*, (pine,) and *F. Virginiana*, (scarlet)—*never blend with each other by any sexual union whatever, and cannot consequently be fertilized except by their own staminates, renders the preservation of both sexes indispensable, where they normally exist on distinct plants.*

As a proof of this fundamental fact there has not, during the two hundred and fifty years which have elapsed since the first interchange of European and American strawberries, been produced a single hybrid between the species of the two hemispheres, or between the three species which are natives of Europe, or between the species which are natives of South with those of North America. The six North American species blend sexually with each other; and the two South American varieties blend sexually with each other, but these two sections can never be sexually blended, nor can any American species ever be blended with those of Europe.

This normal fact of sexual aversion, which forms the scientific basis of all strawberry culture, appears not to be understood, but to be entirely unknown to Europeans, as even the French as well as the English publications recommend that the male hautbois be planted near the Chili and pine varieties, in order to render them fruitful.

The neglect of scientific sexual culture has been more unfortunate in regard to the *F. Chilensis*, the largest strawberry of the earth, than to any other. It appears that when this, which in its native country produces fruit as large as a medium sized hen's egg, was brought to Europe in 1712, only the hermaphrodite variety was introduced, and that its potent staminate, so indispensable to develop this large fruit, was left behind. The neglect of scientific scrutiny, and the apathy which has consequently existed in Europe as to the present vital question, has caused their cultivators to ignore the great advantage attainable by the importation of the other sexual variety; and as the staminates of other species have proved incongenial, the seminal production of this noblest of all strawberries, by improved seminal varieties, has had necessarily to be aban-

doned, and not one representative of this magnificent species now exists in the London Horticultural Garden, and with the exception of three or four *hybridized* seedlings in France, the *F. Chilensis* is only known throughout Europe as a botanical curiosity, not one genuine seedling having ever been produced for want of the other sex. Such is the unfortunate result for which the horticultural savans of Europe are responsible, by their having left the question recently propounded by Mr. Wray to be answered at this late day in the negative: "Is science brought to bear on the art of strawberry culture in England?" Fortunately, we have, by several importations, established a basis for a great extension of the varieties of this interesting family, and can boast of the production of many fine seedlings. Mr. Wray, despite the adoption of the enlightened views lately presented by him, falls into some errors as to culture, which I shall correct in my next article; but there is one which I cannot leave unnoticed at this time. Mr. Keen has been referred to as having made some discovery as to sexuality in 1809. He did so and, as he states in the Horticultural Transactions, his discovery was as to the hautbois strawberry only. Mr. Wray, however, applies this discovery as to his "Keen's Seedling," which was not produced until 1821, to which, of course, it can have no application, and which, with his "Imperial," the only other variety he ever produced, are both of the *F. grandiflora* family, of which no pistillate or female variety has ever yet been produced in Europe, nor yet has one ever been enumerated in the London Horticultural Society's catalogues to the present hour. Mr. W. fell into this error, probably, by following Mr. Longworth, who makes the same transposition of facts and dates. The "pistillate Keen's Seedling" that found its way to Mr. Longworth is a misnomer. It is a native seedling of Indiana, of the wild prairie species, termed *F. Illinoiensis*. I obtained it in 1847 from Mr. Longworth, who supposed it had been imported from England; and I also obtained from him the "Necked Pine," which proved to be another pistillate of the same Illinois species, although bearing a foreign title. Prof. Huntsman (our closest observer of the strawberry) and myself tested both, and we had many a laugh about the supposed voyage across the Atlantic. Mr. Hooper, also, author of the "Western Fruit Book," who resides within a mile of Cincinnati, states that the "pistillate Keen" came from Indiana. Many of us were then cultivating the true Keen's Seedling and Imperial, which my father had received from the London Horticultural Society, and which were the same as have been cultivated here and in Europe down to the present period. Neither will produce a full crop unless attended by a pine staminate. At the present time, it is the *male organs* of all the European hermaphrodite pine varieties, and not the *female organs*, as Mr. Wray, in common with others, supposed, that demand an application of a corrective by staminates.

THE NORTH AMERICAN SPECIES OF THE STRAWBERRY AND THEIR MOST ESTIMABLE VARIETIES.

NOTE.—H. denotes the hermaphrodites, P. the pistillates.

It is indispensable that the pistillate varieties be accompanied by one-tenth their number of some hermaphrodite variety of a North American species, as they do not blend sexually with those of the other continents.

N. B.—The term "large" is always used relatively to the same species or family.

Adonis, P.; large, round, oblate, bright light scarlet, handsome, sprightly flavor, vigorous, very productive, late.

Baltimore Scarlet, P.; very early, medium size, bright scarlet, productive; valuable for market.

Berenice, P.; large, light scarlet, red flesh, firm, very productive; a good market berry.

Chilian, H.; medium to large, conical, bright crimson, firm, rich flavor; plant vigorous and very productive.

Coppock, P.; large, round, deep scarlet, fine flavor, highly productive, very vigorous; an excellent market fruit.

Cornucopia, H. and P.; rather large, conical, scarlet, firm, brisk flavor, suitable for market. Of this variety we have both sexual divisions; the pistillate variety produces the larger crop.

Crimson Cone, P.; medium size, oblong cone, bright crimson, firm, sprightly acid flavor; it is showy, exceedingly productive, and is grown extensively for market, although inferior to many others.

Cutter's Seedling, P.; large, obtuse cone, light scarlet, good flavor, productive; suitable for market.

Diadem, P.; very large, rounded, light scarlet, pleasant flavor, very beautiful, exceedingly productive; suitable for all purposes. Martenus Bergen, a very extensive grower for market, remarked that he did not believe it possible that so great a quantity of fruit could be produced as he saw on my beds of this variety.

Eclipse, P.; medium, conical, bright crimson, brisk flavor; a good early market berry, exceedingly productive, and the fruit ripens nearly all at same time.

Elizabeth, P.; a new Ohio variety.

Fragaria Lucida, of California; small berry, very vinous flavor; a botanical curiosity.

Globose Scarlet, P.; very large, rounded, orange scarlet, beautiful, mild flavor; rather soft for market.

Hovey, P.; very large, obtuse cone, deep crimson, good flavor, very firm; an estimable market berry.

Hooker, H.; large, conical, crimson, fine flavor; too soft for market; the plant tender, and often winter killed.

Hudson's Bay, H. and P.; we possess both sexual divisions. Size medium, obtuse cone, light scarlet; flesh tender, pleasant mild flavor, ripens very early; the pistillate variety produces the larger crop.

Imperial Crimson, P.; large, short cone, fine flavor, firm, productive; suitable for market.

Imperial Scarlet, P.; large, obtuse cone, bright scarlet, sprightly flavor, firm, not affected by rain; estimable for market.

Iowa, H.; large, rounded, light orange scarlet, inferior acid flavor; moderate crop, but very early, and grown largely for market at the west from want of better early varieties.

Jenny Lind, H.; medium, conical, light scarlet, moderate crop, good flavor: an early market berry, but far surpassed in beauty, flavor, and productiveness, by the "Welcome," herein described.

Lawrencia, P.; large, conical, bright scarlet, fine flavor, estimable.

Ladies Pine, P.; moderate size, pale scarlet, exquisite aromatic flavor.

Le Baron, H.; early, large, obtuse cone, dark red, very sweet, and the highest flavored of the large American varieties.

Longworth's Prolific, H.; large, rounded, light scarlet, fine flavor, moderate crop; the blossoms are few but very perfect, and each one perfects a berry.

Macy's Seedling, H.; early, large, scarlet, rather acid; too tender for market.

May Queen, American, P.; medium, scarlet, fair flavor, rather acid, very productive; an early market berry.

McAvoy's No. 1, P.; large, roundish, light bright scarlet, rather acid; a late market berry.

McAvoy's Superior, P.; large, rounded, crimson, good flavor; too tender for market. The defect in its fertilization may be remedied by double the usual number of some strong staminate being planted near it.

Melanie, P.; large, conical, deep scarlet, beautiful, fine flavor.

Malvina, P.; large, obtuse cone, deep crimson, good flavor, firm, productive; valuable for market; resembles Hovey, but is earlier.

Orange Prolific, P.; large, conical, orange scarlet, rather acid; suitable for preserves.

Ophelia, H.; large, rounded, scarlet, firm, good flavor; a suitable fertilizer for the Scarlet Magnate.

Paulinus, P.; large, conical, bright scarlet, fine flavor.

Peabody, H.; character well known; unsuitable for the north.

Parnel, P.; a new Ohio seedling, grown by Mr. Parnel, of College Hill; large, crimson, fine flavor, productive.

Primate, H.; large, conical, deep scarlet, moderate flavor, firm; a good market berry. A peculiar variety, very perfect in its blossoms, which are not numerous, but each of which perfects a berry.

Prince's Late Globose, P.; very large, rounded, bright orange scarlet, fair flavor, very productive, firm for carriage; a showy market berry, ripening eight or ten days after the main crop.

Prince's Scarlet Climax, P.; large, obtuse cone, bright scarlet, fine flavor, very productive; a splendid market berry.

Rosalind, P.; rather large, short cone, bright scarlet, fine flavor; suitable for market.

Scarlet Magnate, (Prince's,) P.; largest and heaviest of all the North American varieties yet produced; of a distinct form, rounded, oblate, bright scarlet, very solid; suitable for lengthy carriage, juicy, sweet, fine flavor, very productive; the most splendid of all market berries. Dr. Bayne, a very extensive grower, who has, during twenty years' experience, tested more varieties than any other market grower, prefers it to all others, and has now adopted it for his main crop. It has been most ignorantly stated in one of the nursery catalogues that the plant is "moderately vigorous," and in another as "often of weak growth," although they praise the fruit. It is doubtful whether either ever saw the plant, as it is the strongest and most vigorous in growth of all the American scarlet varieties. It therefore requires a vigorous staminate, such as the Ophelia or Iowa. This noblest of American strawberries is destined to be the basis and parent of a new and splendid race of peculiar form and robust character.

Scarlet Melting, P.; early, over medium, short cone, very good flavor; too soft for market.

Scarlet Prolific, H.; medium size, conical, bright scarlet, extra sweet flavor, estimable.

Sirius, H.; very large, conical, orange scarlet; the sweetest and best of the Iowa family, whose natural character is acid.

Superlative, P.; medium, conical, light scarlet, rich spicy flavor; produces a moderate autumnal crop if irrigated; a fine family berry.

Suprema, P.; large, obtuse, bright scarlet, sprightly flavor; very productive.

Supreme Staminate, H.; monstrous, obtuse cone, bright deep scarlet, good flavor; a remarkable berry.

Stewart, P.; medium, obtuse cone, sprightly flavor; a seedling of the crimson cone and similar in character.

Trevirana, P.; large obtuse cone, light scarlet, sprightly flavor, valuable.

Triumph, H.; very early medium, pointed cone, bright scarlet, mild flavor, beautiful.

Triumphant Scarlet, H,; very large, conical, bright scarlet, splendid, fine sprightly flavor; ripening gradually from fifteen to twenty days.

Triumvirate, H.; large, obtuse cone, bright scarlet, good flavor.

Valencia, H.; large, obtuse cone, bright scarlet, good flavor, valuable.

Walker, H.; medium, obtuse cone, dark crimson, fine flavor, moderate crop. A seedling of the old Black Prince.

Wilson's Albany, H; large, obtuse cone, dull dingy crimson, deep red inside, firm, inferior flavor until fully ripe, it then becomes soft, sweet and pleasant. It has to be marketed before maturity, being then firm, but very acid; if deferred, it becomes too soft to bear carriage. It is suitable for preserves; very productive for its sex, but becomes exhausted after one crop in consequence of its profusion of blossoms.

Albion, H.; large to very large, pure white, with a rosy tinge at base; flesh white, very firm, juicy, high vinous flavor; plant of strong growth, robust, very hardy; foliage large, thick, dark green, with long petioles, distinct from Lennig's white.

American Queen, P.; very large. perfect cone, bright scarlet, good flavor, rather acid, beautiful, productive.

Austin's Seedling, H.; very large, irregular cone, light scarlet, rather acid; soft, not suited for market.

Ariadne, P.; large, conical, crimson, firm, fine flavor; very productive, highly estimable.

Bayne's Early Scarlet, H.; a larger and superior variety of the Early Scarlet or Virginia.

Downer's Prolific, H.; rather large, obtuse cone, bright scarlet, good flavor, productive.

Estelle, H.; rather large, conical, dark scarlet, exceedingly sweet, greatly productive, very late.

Fillmore, P.; rather large, rounded, crimson, firm, vigorous, productive.

Florence, P.; very large, short cone, splendid scarlet, fine flavor, firm, ex ceedingly productive; an admirable showy market berry.

Fortunatus, P.; large, obtuse cone, bright scarlet, fine sprightly flavor, very productive.

Fragrant Scarlet, P.; large, conical, high perfumed flavor, very estimable.

Heroine, P.; large, obtuse cone, deep scarlet, sweet, fine flavor.

Hein's White, H.; large, white, slight rosy tinge, fine flavor.

Honey, a new Ohio variety of great sweetness.

Iphigene, P.; large, long cone, deep crimson, rather acid, productive.

Jennette, H., (Reeves;) medium, oblong, light scarlet, tender, juicy, high flavor, exceedingly productive.

Jenning's Indiana, P.; rather large, obtuse cone, crimson, brisk flavor, excel lent, very productive.

Lennig's White; a remarkable large white berry, with a slight rosy tinge; fine flavor; ripens late; plant very hardy, vigorous, and productive. A seedling of Wilson's Albany.

Minerva, P.; large obtuse cone, deep scarlet, fine flavor, very productive; an admirable market berry.

Nathalie, P.; very large, conical, light scarlet, good flavor, remarkably productive.

Perfumed Cone, H.; rather large, obtuse cone, bright scarlet, firm, high aromatic flavor, very productive, greatly esteemed; an admirable family berry.

Priscilla, P.; very large, conical, scarlet, good flavor, very productive, valuable.

Prince's Excelsior, P.; very large, obtuse cone, deep scarlet, sweet, high flavor, very estimable, greatly productive, late.

Sappho, H.; very large, conical, light scarlet, good flavor, beautiful, very productive, valuable.

Seraphine, P.; monstrous, obtuse cone, bright scarlet, white flesh, sprightly flavor, splendid, very productive, highly estimable.

Scarlet Prize, P.; very large, late, rounded, beautiful, sweet, fine flavor, very estimable in all respects.

Victorine, H.; very large, conical, bright scarlet, good flavor, showy, distinct; firm for market, very productive and valuable.

Ward's Favorite, P.; large, round, crimson, fine flavor.

Wardlaw, H.; early, large, round, scarlet, productive.

Waverly, P.; very large, oblong cone, dark scarlet, good flavor, firm, estimable.

Warren, P.; very large, rounded, scarlet, juicy; fine flavor, valuable.

Welcome, H.; earliest and handsomest variety that combines large size, fine color, flavor, and productiveness, and is consequently the most important early market variety; conical, light bright scarlet, firm, very sweet, juicy, excellent. It is one of that section of the hermaphrodite class which produces on some peduncles entirely bisexual and on others entirely pistillate flowers.

White Pine-apple; this is supposed by some to be identical with the Albion, and may prove so. It is one of the hardiest and most vigorous varieties; fruit large, white, high flavored, between a peach and pine-apple; very productive.

EUROPEAN SEEDLING VARIETIES OF THE FRAGARIA GRANDIFLORA, OR PINE STRAWBERRY OF SOUTH AMERICA.

All these varieties are hermaphrodite, and will require to be accompanied by a staminate of their own species, or of the Chili, in the proportion of one-tenth of the latter. This family does not blend sexually with any other than the varieties of Fragaria Chilensis.

Ambrosia; early, very large, rounded, deep glossy scarlet, firm, rich mulberry flavor, very sweet and juicy; a superior variety.

Auguste Rictmeyer; very large, oval or round, vermillion; flesh salmon, very firm, juicy, exquisitely sweet; highly estimable.

Beauty of England; very large, flattened, deep red; flesh red, juicy, sweet, perfumed; very estimable.

Bell's Excel; earlier and as large as the British Queen.

Bicton White Pine; large, obtuse cone, some flattened, white bronzed, fine flavor, beautiful; plant tender, moderate bearer.

Bonté de St. Julien; early, large, round, very sweet, fine flavor, perfumed.

Caroline, Scarlet, or Grandiflora; original type of the F. grandiflora, bright scarlet, sweet, perfumed.

Caroline, Rosy White; large, variable in form; flesh white, with rosy tinge; juicy, slightly perfumed; plant vigorous, productive.

Carolina Superba; a very distinct and admirable variety, extra large, obtuse cone, beautiful, light scarlet, firm, sweet, delicious flavor; the plant tender and produces a poor crop, unless grown in a warm protected location and under special care.

Comtesse de Beaumont; bright scarlet, flesh rosy, sweet, juicy, perfumed; plant very vigorous, highly productive.

Crimson Queen; very large, form variable, rich crimson, firm, juicy, sweet; most agreeable perfume; plant vigorous, moderate crop, late; it requires rich soil, a warm location, and careful culture; in our climate the foliage burns badly.

Delices du Palais; round, deep lucid scarlet, very firm, jucy, sweet, highly perfumed, delicious, early; plant vigorous, productive.

Dr. Karl Koch; oblong, bright orange scarlet, rather firm, rosy flesh, sweet, high flavored, excellent; plant hardy, productive.

Duc de Malakoff; very large, often monstrous, round or coxcomb, deep scarlet, very firm, sweet, apricot flavor, has weighed $1\frac{3}{8}$ oz.; plant vigorous, productive, superior for forcing.

Duke of Cambridge; pointed cone, bright scarlet; flesh rosy, very firm, sweet, high flavored, very beautiful; plant hardy, productive.

Duke of Cornwall; originated by Mrs. Clements, of Cornwall, England; not yet fruited here.

Eleanor, (Myatt;) very large, elongated cone, brilliant scarlet, glazed; flesh fine, juicy, acidulate, good flavor; plant very productive when specially cared for; ripens quite late.

Eliza, (Rivers;) round, conical, light scarlet; flesh delicate, sweet, perfumed, pine apple flavor, excellent; plant hardy, fair crop.

Emily, (Myatt;) round or compressed, bright roseate; flesh white, juicy, sweet, pleasantly acidulate; plant hardy, good late crop.

Emma; obtuse cone, or round, bright lucid scarlet; flesh rosy white, juicy, sweet, perfumed; plant hardy, productive; a highly esteemed variety.

Empress Eugenie; monstrous berry, round, oval, or coxcomb, deep glossy crimson; flesh red, very juicy, sweet, delightful flavor, most exquisitely perfumed; this berry has weighed 1¼ to 1½ oz.; plant hardy, vigorous, very productive, forces admirably.

Excellente; very large, round or compressed, deep scarlet; flesh rosy, very fine flavor; productive when in a warm and sunny location and properly cared for.

Eclipse, (Reeve;) early, conical or compressed, light crimson, firm, juicy, rich pine-apple flavor, a rare quality; plant bears abundantly, forced admirably.

Exhibition; proves to be old "Prince Albert" renamed in England; flat and deficient in flavor.

Filbert Pine; a distinguished variety which requires a warm protected situation and special culture; it is then quite productive. Form oblong, scarlet; flesh white, firm, of very superior excellence. The plants bear but one crop and then decay.

Frogmore Late Pine; superior to all other late varieties; very large, of extreme beauty, conical, sometimes compressed, brilliant crimson, firm, very juicy, rich perfumed; it is later than any other of its class, and a great acquisition in all respects.

General Havelock.—This appears to be the old "Cremont," a French variety, which has thus been rechristened in England.

Goliah; quite large, obtuse cone, vermilion; flesh firm, rosy white, juicy, perfumed; plant vigorous, productive under proper treatment. It was at one time condemned in England, but is now successfully cultivated.

Imperatrice Eugenie; a beautiful berry, conical, bright, glossy, roseate; flesh firm, rosy white, sweet, perfumed, highly esteemed.

Jucunda; very large, sometimes monstrous, variable form, vermilion, very beautiful; flesh rosy, sweet, juicy, but little perfume; it has a cavity; plant very hardy, vigorous, productive.

Jung Bahadoor; obtuse cone, deep scarlet; flesh rosy, firm, juicy, sweet, delicious; plant hardy; bears well.

King Arthur; originated by Mrs. Clements, of Cornwall, England; has not yet fruited here.

La Chalonnaise.— This plant is tender and requires a warm sheltered location, and very careful treatment; a very beautiful fruit, very large, conical or compressed, vermilion; flesh white, juicy, sweet, first quality, productive.

La Constante; berry perfect in all respects; declared by M. De Jonghe to be the most estimable of all his seedlings; large, very regular cone, bright glossy scarlet; flesh rosy white, very firm, sweet, perfumed, exquisite; a splendid berry; ripens late; plant dwarf, vigorous; very productive; succeeds in various soils and situations; forces well for two seasons.

La Delicieuse; a peculiar variety, round or compressed, apricot color; flesh yellowish, compact, very sweet, perfumed; plant vigorous; productive; fruit ripens late; very unique in the color of fruit and flesh; the plant requires a warm sheltered location and careful culture.

La Grosse Sucrée; oblong, crimson at maturity; flesh white, firm, sweet, highly perfumed; late; plant vigorous, hardy; very productive.

La Perle; high-flavored, very good, oblong, orange scarlet; flesh white, delicate; plant vigorous. It is deemed a shy bearer, but Mr. Gloede finds it to bear well when it is two years old.

La Reine, (De Jonghe;) a very interesting variety, elongated form, rosy white; flesh white, firm, sweet, perfumed; moderate crop. There is a scarlet variety erroneously called by this name.

Ladies' Finger, (English;) variable in form, usually very oblong, whence its name, orange scarlet; flesh white, delicate, sweet, high flavored, very estimable; plant very vigorous, hardy, productive.

La Sultane; declared by M. De Jonghe to be second only in value to his "La Constante." A magnificent berry, large, conical, often two seemingly united, brilliant glossy scarlet; flesh white, firm, juicy, sweet; highly perfumed; plant vigorous, productive, rather early.

Leopold; variable in form, deep scarlet; flesh rosy, juicy, vinous; flavor delicious.

Lorio; early, oblong, compressed, bright scarlet; flesh rosy, very sweet, perfumed; productive.

Lucas; an admirable and peculiar variety; a seedling from "La Constante," and perhaps superior in several points to that estimable variety; berry very large, beautiful, round or oval form, glossy crimson; flesh rosy white, very firm, juicy, sweet, extremely rich flavor; plant very hardy, vigorous, and productive.

Margueritte; very large, often enormous, has weighed 1¼ ounce; beautiful oblong form, bright lucid scarlet; flesh bright orange, firm, juicy, sweet, high flavored; it remains a very long time in bearing. It may be termed both early and late; it also forces well. This plant is destined to an important career, as it combines so many estimable points, and has been awarded numerous prizes at the European exhibitions.

Marquise de Latour Maubourg is synonym of Viscomtesse Hericart.

Merveille de Flandres is Bicton White Pine.

May Queen, (English;) earliest of the pine family, round, pale scarlet; flesh white, firm, sweet, high aroma; plant hardy, productive, forces well. Some English growers have partially condemned it.

Mrs. D. Neilson; variable in form, orange scarlet; flesh white, juicy, sweet, high flavor; plant hardy, productive; fruit ripens very late.

Napoleon III; round or compressed, bright roscate; flesh white, firm, sweet, very high flavored; plant very vigorous, hardy, highly productive; fruit ripens late, very estimable, and merits the highest encomiums.

Ne Plus Ultra; often monstrous, variable in form, crimson, almost black at maturity; flesh firm, roseate, juicy, acidulate, good flavor; very early; very suitable for preserving whole; plant vigorous, productive.

Newton Seedling; large, rich deep scarlet, superior flavor, very firm; plant hardy, very productive; long in bearing; forces well.

Omer Pacha has proved to be the old "Myatt's Eliza," long since discarded, but renamed in England, and is now running its second course.

Orb; very large, fine form, usually globose, sometimes oval, bright roseate; flesh yellowish, compact, sweet, rich, exquisite flavor; plant dwarf, very hardy and productive. It is a variety worthy of the culture of real amateurs.

Ornement des Tables; early, very beautiful, oval, glossy orange scarlet; flesh salmon, compact, very sweet and juicy, with a delicious aroma; plant very productive.

Oscar; early, round or conical, rich glossy crimson; flesh rosy white, very firm but melting, very sweet, exquisite aromatic flavor; plant of a strong hardy dwarf habit, very vigorous, with dark green foliage; forces admirably.

Prince Alfred, (Stewart & Neilson;) very large, often monstrous, irregular form, vermilion; flesh white veined with red, juicy, very sweet, perfumed; highly estimable; plant vigorous, very productive.

Prince Arthur, (Ingram;) originated at the Royal Garden of Frogmore, and cultivated there on an extensive scale; handsome oval form, orange scarlet, very glossy; flesh firm, white, juicy, sweet, pleasantly acidulate; plant hardy, very productive; fruit ripens very early; forces well.

Prince Imperial; one of the earliest of its class, varnished scarlet, variable in form, above medium size; flesh rosy, sweet, fine flavor; plant very productive, long in bearing; very suitable for forcing.

Princess Frederick William; one of the earliest of the pine family, beautiful, rounded, sometimes coxcomb, brilliant scarlet; flesh rosy white, firm, sweet, high flavored; plant very vigorous, productive, and very suitable for forcing.

Princess Royale, (Pelvilain.) This French variety is highly valued for its earliness in forced culture; oblong, bright glossy scarlet, often with a white point, very beautiful; flesh firm, scarlet, quite acid; plant very productive.

Quinquefolia, or Five-leaved; variable in form, bright roseate; flesh firm, sweet, high flavored; it succeeds only in pot culture, or in a warm and sheltered location.

Reine Hortense; a good berry, but unproductive and of no value.

Rifleman, (Ingram;) resembles British Queen, of first quality, but requires a warm, sheltered location; it is also suitable for pot culture, and forces well.

Rifleman, (Dr. Roden;) very large, variable in form, conical, compressed, or coxcomb, bright glossy scarlet; flesh firm, juicy, sweet, high flavored; plant dwarf, very hardy; ripens early, and is long in bearing.

Robert Trail; very large, pointed heart shape, vivid glossy scarlet; flesh rosy, very firm, sweet, juicy, exquisite; plant very vigorous, productive; fruit ripens late.

Royal Victoria; handsome, rounded, orange scarlet; flesh white, delicate, sweet, perfumed; plant hardy, productive; fruit ripens early.

Rushtoniensis, originated by the Rev. W. F. Radclyffe, of Rushton, England; medium size, dark red; flesh nearly red throughout, very good; plant of strong, hardy habit, very productive, continues long in bearing; a very useful variety.

St. Lambert; very handsome, regular form, dark crimson; flesh firm, red, juicy, fine flavor; plant hardy, productive.

Scarlet Nonpareil; although superior under pot culture, or in warm climates, at the north it cankers, and is an inferior fruit, on account of the tenderness of the plant.

Sanspareil, (Culverwell;) a new variety, oblong cone, deepest crimson; flesh firm, solid, red throughout, very rich, excellent flavor; plant vigorous, forces well.

Scarlet Cluster; originated by Mrs. Clements, of Cornwall, England, but has not yet fruited in this country.

Sir Harry; a very large, magnificent fruit, but will only succeed in a hot climate or under pot culture.

Sir Charles Napier; rather tender, requiring special culture, and a warm sheltered position; a beautiful berry, rather large, long pointed, heart shape, vermilion; flesh white, rather acid, good flavor; plant productive, suitable for forcing.

Surprise; enormous size, variable in form, pale orange; flesh white, of modest flavor at the north, and quite insipid unless in a very warm and sheltered location; requires special culture, and is then very productive. It is well suited to warm climates, where it will no doubt be of excellent flavor.

Triomphe de Gand.—It is quite remarkable that this variety, so much trumpeted here, is not named in the principal French, Belgian, and English strawberry catalogues, and only in Rivers's general fruit catalogue, and there

not in his descriptive list, but among the supernumeraries. This would indicate that it has been deemed inferior to most others of its class, as we have ourselves found it to be as to quality. The berry is large, obtusely conical, of regular form, bright crimson, juicy, firm, deficient in flavor and perfume; the plant continues long in bearing, but with only a moderate number of berries at any one time, the entire crop amounting to not more than one-third or one-half the quantity of an ordinary field crop from other varieties. Although it is one of the hardiest of the imported pine varieties, yet, like all others of that family, it cannot be made to succeed in open field culture in any latitude north of the Potomac, unless it be in some warm and sheltered location, and then it must be accompanied by a staminate of its own pine family. Most cultivators claim for it only a moderate crop. The market growers who have planted of it extensively are destined to disappointment, as already has been the result with every other variety of its class. It can, however, be successfully grown in hills under garden culture, in rich soil, if carefully cared for.

Turner's Pine; early, large rounded, bright scarlet; flesh rosy, excellent quality; plant vigorous, productive.

Vicomtesse Hericart; fruit round or compressed, bright scarlet, vermilion; flesh solid, white, very sweet, perfumed.

Victoria, (Trollope;) second quality in flavor, and a poor bearer. Rejected.

Wellington; a Scotch variety, medium size, rounded, good quality, productive; a favorite with the market gardeners of Scotland.

White Brittany Pine; an English variety not yet fruited here.

Wizard of the North.—This much puffed variety, we fear, is doomed to disgrace. Turner, of London, denotes it as "small." Rev. W. F. Radclyffe, of England, a most reliable authority, writes me that it is "worthless." In Mr. Nicholson's catalogue of 1860, it is rated thus: "Good size, deficient in flavor and pasty, great bearer, an useful sort;" but it was then only known by Scotch report, it not having then fruited in England.

Wonderful; oblong compressed, bright rosy; flesh solid, white, sweet, fine flavor; plant hardy, very productive; fruit ripens late, bears long carriage. This is said to be the old "Sir Walter Scott," rechristened in England.

FRAGARIA CHILENSIS, OR CHILI STRAWBERRY.—THE SPECIES AND HYBRIDS.

N. B.—These are all hermaphrodites, and require to be accompanied by a staminate of their own species to insure a perfect natural crop. They will, however, blend sexually with the F. grandiflora, or pine family, but such union being uncongenial, the crop will be diminished.

Chili, (true;) the original hermaphrodite variety first obtained; berry monstrous, variable in form, pale red; flesh rosy, with a cavity; plant very strong, moderately productive, unless accompanied by its own staminate; it requires a warm, sheltered, and sunny location, it being more tender than any of its seedlings, they having become measurably acclimated by seminal reproduction.

Chili Yellow; a genuine variety, very large, conical or ovate, sometimes compressed, orange scarlet, splendid; flesh yellowish, fine rich flavor, some acidity, very firm, with a core.

Chili Orange; a genuine variety, it having been grown from its hermaphrodite parent without admixture; fruit large, rounded, bright orange; flesh yellowish, very sweet, aromatic, excellent; plant vigorous growth, productive.

Chili White; a genuine variety, much resembles the original Chili, form variable, white tinged rosy; flesh firm, white, fine flavor; a peculiar and interesting variety.

Formosa; a genuine imported variety, very large, dull glossy brownish red, ovate or obtusely conical, often coxcomb; sweet, high aromatic flavor, excellent; only moderately productive unless attended by its own staminate.

Large Scarlet Chili; imported forty years ago from Lima; very large, long, conical, scarlet; flesh rosy, high aromatic flavor, very vigorous.

Montevideo; imported in 1840; very large, regular cone, slightly variable, orange scarlet, splendid; flesh yellowish, rich pine-apple flavor; plant vigorous, productive; blossoms the size of a dollar. From this parent we have grown many seedlings.

Huntsman's Chili; hybrid, large short cone, and variable light bright scarlet, on very short peduncles; mild flavor, ripens late, very productive, long in bearing, of dwarf habit. A seedling of the preceding variety grown by Professor Huntsman.

Jouna or Flauter; hybrid, large, round, buff color; flesh creamy, firm, good flavor.

Lucie; hybrid, large, variable in form; flesh firm, good flavor; ripens very late.

Madame E. Vilmorin; hybrid, very large, variable in form, orange rosy; flesh white, very delicate, perfumed, exquisite flavor; moderately productive unless accompanied by a true Chili staminate, as is also the case with other varieties.

Premices de Bagnolet; hybrid, large and very beautiful; fine flavor, firm; forces well, and flourishes in a warm sunny location.

Salmon or Buff; large, irregular form, salmon color; flesh yellowish tinge, fine flavor; ripens late.

Souvenir de Nantes; hybrid, large, variable in form, of good flavor; ripens very late.

EUROPEAN INDIGENOUS SPECIES OF THE STRAWBERRY AND THEIR VARIETIES, THE HAUTBOIS FAMILY.—(*F. Elatior.*)

Fragaria elatior; the original type, usually called hautbois. The French call this class "*Caprons.*" This family comprises three sexual divisions, and the hermaphrodites and pistillates require their own staminate for fertilization.

Black Hautbois; fruit medium or small, dark red, nearly black at maturity; flesh buttery, highly aromatic musk flavor, greatly esteemed by real amateurs.

Bijou des Fraises, from Germany; new, very large, highly esteemed.

Belle Bordelaise; earliest of its class, and of incomparable productiveness; fruit medium size, conical; flavor extremely rich; forces admirably. If grown in a moist soil, and plentifully irrigated, it will produce a considerable autumnal crop.

Monstrous Hautbois; new, the largest of its class, highly esteemed; it makes but few runners.

Myatt's Fertilized Hautbois; berry of medium size, conical, high flavor; ripens late; it makes very few runners.

Prolific Hautbois; large, obtusely conical; high flavor; productive. If grown in a moist soil and plentifully irrigated, it will produce a second crop in September.

Rivers's Monstrous Hautbois; this is a new seedling of much promise, and one of the largest fruiting varieties.

THE EUROPEAN WOOD VARIETIES.—(*Fragaria vesca.*)

These are perfect flowering hermaphrodites. The berries of all are small when contrasted with those of the North and South American species; but as they are very profuse and long bearers, and always reliable for their crops, and the fruit possessing a peculiar wild and pleasant flavor, they have always been much esteemed.

European red wood or alpine wood.
European white wood.
Montreuil red wood; one of the best.
Montreuil white wood.
Hative de Fontenay; small, earliest.
Red bush wood; no runners.
White bush wood; no runners.
Plymouth or Muricata; a monstrosity, with large greenish flowers, and prickly fruit.
Double flowering; no fruit.
Versailles or Monophylla· one leaved—a curiosity.

ALPINE MONTHLY, OR QUATRE SAISONS.

These belong to the same species or family as the preceding, but are everbearing varieties, producing fruit very similar in form and quality to the preceding. The original red and white varieties are natives of the summits of the Alpine mountains.

Alpine Monthly Red.
Alpine Monthly White.
Gaillaude Red Alpine.
Gilbert's Large Brown Alpine.
Gloede's White Alpine.
Gloede's Dark Red Alpine.
Gloire de Nancy Alpine.
Gloire du Nord Alpine.
Gloire de St. Genis Alpine.
La Mendonaise Alpine.
Perpetuel de Poiteau.
Reine des Quatre Saisons.
Versailles Quatre Saisons.

N. B.—The eleven last named are improved seedling varieties and recent acquisitions.

Red Bush Alpine; no runners.
White Bush Alpine; no runners.

N. B.—The two last named are called by the French "Gaillons."

GREEN ALPINE, OR PINE-APPLE STRAWBERRY.

Fragaria collina; an hermaphrodite species. The fruit of this family are of moderate size; greenish, tinged with red; of musky, rich pine-apple flavor, for which it is greatly esteemed. The fruit ripens late and matures beneath the foliage; and the plant is a curiosity, on account of its very distinctive character.

Green Pine-apple; the original species.
De Bargemont.
Champagne vineuse.
Heterophylla, or Various-leaved; a curiosity.

WORN-OUT LANDS OF NEW JERSEY.

BY CHARLES STOKES, OF STOKINGHAM, BURLINGTON COUNTY, NEW JERSEY.

In the State of New Jersey there is a variety of soil, from the tenacious clay to the light and drifting sand. In the southerly part of the State, from the Delaware Falls, at Trenton, the sandy or light character is most general.

In the early settlement, which commenced in the latter part of the seventeenth century, the tide-water locations were preferred on account of the many facilities of communication, water, &c., which they afforded. And very generally along the margin, and for some distance back from the tide-water streams, the soil partook more of the sand than further in the interior; and this description of soil, being more free from underbrush and brambles than the heavier soil,

was an additional reason for its early occupancy on account of its being more easily cleared.

From the history of the colony, particularly as we have it in the interesting descriptions as given in Smith's History, we have a right to presume that these early clearings were remarkably productive in such agriculture as was practiced at that day. The grasses were not cultivated until about the beginning of the present century, the principal dependence for hay being upon upland meadow and the embankment of the marshes, which bordered the tide-water streams. In the virgin and fertile condition of the country the upland furnished good natural grasses for pasturage.

The staple products were Indian corn, wheat, rye, and buckwheat, with vegetables for domestic use. The grains were extensively converted into beef and pork, but more of the latter.

The style of farming was, first, corn, then among the corn in the full was sown wheat and rye, but more commonly rye; and, after the removal of the wheat or rye harvest, the ground would remain with only such natural herbage as might spring up, and in its rough ridgy state, say for two or three years, or until in its regular course it should be again put down in corn, and so on in corn and wheat, or rye and natural grass, such as would grow. Such manure as might be in the stock yard would be removed and put upon the corn ground before ploughing, as far as it would go, and commonly upon those parts of the field nearest the barn. But little care was exercised to increase the quantity of manure, and a substitute was scarcely thought of.

This style of agriculture continued for more than a century, until about the year 1800. The soil became (much of it, and such as had been the longest cleared) very much impoverished, and would but ill repay the expense and labor of tillage. Garlic, poverty grass, and briars, and burr grass upon the sandy soils, had become the covering of many fields, and farming, as a business, compared to disadvantage with commercial and professional pursuits.

But about the year 1800 a new epoch commenced as regards agriculture in this part of the State, as I presume was the case in many other sections of our country.

This may be accounted for in the low state of business; that a change for the better had become absolutely necessary for the comfortable subsistence of those whose living depended upon it; and also, in part, by the fact that the wars in Europe were opening a better market for farming produce than had been known theretofore. But, whatever the cause, a new spirit took possession of many of the more energetic and enterprising farmers. It was soon found that the soapers' drawn ashes were an excellent manure. They were in the first place procured for little more than the price of freighting them to the landings upon our navigable streams, whence they were carted and applied to the worn-out fields at the rate of about one hundred and sixty bushels to the acre. The effect was most striking. Ground that would hardly produce five bushels of corn to the acre, with this dressing of ashes would yield fifty bushels. The effect upon rye was equally beneficial, but not so much upon wheat.

The system of farming also changed about this time. Instead of sowing wheat and rye with the corn, as mentioned above, the corn stubble was ploughed in the spring and left for open fallow, or sown in oats, (which had previously to this been but little cultivated,) and in the fall was sown with wheat or rye, and in the following spring seeded with clover.

The barn-yard manure was used as far as it would go, and the remainder of the ground was covered with ashes. It was now found that ashes as well as stable manure were well adapted to the growth of the grasses, and, as a consequence, the face of the country in many districts underwent a great change. About this time, also, marl of an excellent quality was found in many neighborhoods throughout several of the counties. As this came into use, the impetus which

had already been given to improvement was sensibly increased, and has continued up to the present time. Nearly the whole agricultural population have become stimulated, so that a poor, old, worn-out field or farm is now but very rarely seen.

Since the introduction of ashes as a manure, there have been various other substances made use of, with more or less benefit. The great demand for the ashes soon enhanced the price, so that many farmers discontinued the use of them and substituted lime. This change has been gradually going on, until ashes are now but little used. Indeed, these are to be had only in limited quantities, owing to the almost universal substitution of coal for fuel.

The improved condition of the agriculture in this section of the country was for many years mostly confined to those soils of the heavier character, as being better adapted to the growth of grass; and the sandy land farms were neglected, under the impression that sands of this description were much inferior to the heavy and clay soils. This opinion latterly has undergone very considerable change, so much so that we sometimes hear the expression that our light land will be found to be our best land.

This change has been effected by the new mode of treatment. Ashes operate most beneficially upon worn-out, sandy soils, when they are applied; and were it not for the expense would probably be the best application. But as ashes are not readily had, an excellent substitute, and at much less expense, is found in lime and muck, or marl. The marls of New Jersey are so well known that a description of them, or their location, may not be necessary. But our extensive beds of muck are less noted, and a few remarks upon them may not be without interest. They consist mainly of vegetable deposits, intermingled with earthy substances, and are found in low and marshy places along our inland streams, and the alluvials, intervals which in many places border our tide-waters. It can often be dug from four to six feet in depth. There are various ways of procuring and using it. The plan most generally adopted in this vicinity is to have the muck dug and wheeled on barrows to the fast land, where it can be reached with teams. The cost of this is about ten cents for a ton of twenty cubic feet. Here it had better remain to undergo the frosts of at least one winter, when it may be mixed with lime, (slaked,) with salt water is thought to be best—three bushels of lime to the two tons of muck—and then applied to the soil, at the rate of fifteen or twenty tons to the acre. A like admixture of lime with marl is by many thought to be the best mode of treating marl. When so mixed, ten tons to the acre is believed sufficient. But the more common mode; and one better suited to the habits of most farmers, is to cart the muck upon the land at leisure times, put it in heaps to receive the action of the frost, and spread in the spring; and at the same time apply the lime, well slaked, and thoroughly incorporate them with the soil by tillage. After a summer crop sow down with rye, and in the spring following with clover seed. Previously to sowing the clover seed the ground should be harrowed with a common spiked-tooth harrow, as the best mode of insuring the growth of the seed.

If the clover endures the drought of the first summer, (which is the principal difficulty,) then give a dressing of ten tons of marl to the acre, or one bushel of gypsum, or both. And if the season be favorable for grass, two tons of hay may be gathered from an acre where there had previously been nothing but sand bars.

And when a clover sod is thus obtained the ground is prepared for a course of profitable farming with any kind of crops for which it is adapted. By this course of treatment the character of the soil becomes changed and solidified, and is far less liable to drift with the wind. If a judicious course of farming be pursued afterwards with the same policy, as regards manuring, as is practiced with the heavier soils, there will be but little reason to consider the sandy or light soil as inferior.

Within the circle of my personal knowledge in this State there has been a most marked and encouraging improvement made in the old and worn-out sandy soils, giving a new and cheerful aspect to the face of the country, as well as affording ample remuneration to the worthy and industrious agriculturist.

And although I have pointed out one particular method of applying the lime, muck, and marl, yet I would not wish to be considered as opposing other plans. I believe these substances constitute the best and cheapest agents in the renovation of old, worn-out, and drifting sandy land; and although there may be some one mode of combination and application better than any other, yet I incline to the opinion that application is the main thing, and that if we get them upon the soil in sufficient quantity, and in a proper state, we shall not be disappointed in the results.

The benefits of stable manure to light and sandy soil may be greatly increased by composting with muck or marl in about equal quantities. This should be done before the manure has passed through a state of fermentation. After the compost has been made let it be properly overhauled with forks and the manure shaken out and mixed with the muck and marl. Thus the whole mass will ferment together and make a better substance than either, by itself, for many kinds of vegetation. This may be considered one of the best modes of using either of these substances; and very suitable after the liming process, and after a clover sod has been obtained as aforesaid.

In the foregoing remarks I have endeavored to confine myself to the fruits of personal observation for a long course of years and practice, in which I have not only noticed the operations of others, but also the results of my own practice.

THE CONSUMPTION OF MILK.

BY SILAS L. LOOMIS, A. M., M. D.

Milk has ever been considered an excellent article of food. From infancy to age, in the civilized world, pure, sweet milk is a prime necessity, and is considered of such importance that the first object of every agricultural association has been to improve the products of the dairy.

The importation of fine English cattle, from the time Washington first brought them to the plains of Mount Vernon to the present day, may be considered a national benefit. No less important is the improvement of the native cow, as is shown by the annual reports of various associations. The efforts to improve the breed of cows have been eminently successful, but not as general as could be desired. It is as true of cows as of any other race of animals, that the breed, however good, will rapidly deteriorate if not properly cared for; and it is also as true that a breed of a medium or even a poor quality will be greatly improved by suitable care and proper attention. To these points almost every agricultural association has directed its attention, and by premiums and honorable notice has been amply rewarded for its efforts. While American cows fall below

the English, Swiss, and German, taken as a whole, they compare very favorably whenever they have had proper attention, as the following statement very clearly illustrates:

STATEMENT 1.

	Quarts.
No. 1. English cow, daily average soon after calving	17.4
2.....do.....do.....do	19.7
3. Swiss cow, daily average soon after calving	16.5
4.....do.....do.....do	18.5
5.....do.....do.....do	20.0
6. American cow, daily average for three months	15.6
7.....do.....do.....do	15.9
8.....do.....do.....do	18.3
9. American cow, daily average soon after calving	25.5

In the above table the daily average of the Swiss cows was 18.3 quarts; the daily average of the English cows, 18.5 quarts; and the daily average of the American cows, although three of them were averaged for three months, was 18.8 quarts.

The average annual product of this class of cows is about 3,000 quarts of milk. In the above table medium first class cows have been selected.

The annual average of six first class cows kept near Buffalo, New York, properly fed and carefully attended to, was 2,288 quarts, the best yielding 2,765 quarts of milk, and the poorest 1,906.

The annual average, taking all the cows over a large extent of territory, is a little less than 1,800 quarts. From all available information we conclude that 1,800 quarts of milk is a fair average annual product of each cow of the present American stock, 1861.

No cow that comes below this average should be milked, yet we find many whose annual yield does not exceed a thousand quarts.

The annual average product of milch cows should be brought up to 2,200 quarts at least.

This subject, as well as the selection of cows, their care and attention, the various kinds of food and its results, the productiveness of milk, of butter and of cheese, times and manner of milking, quality of the milk, profits of the dairy, &c., have been well treated in previous reports, and will not occupy us in the present paper.

CONSUMPTION OF MILK.

Milk is consumed in three modes:

1. In the manufacture of butter.
2. In the manufacture of cheese.
3. In direct consumption as food.

The comparative importance of these three modes of consumption is best seen by the following statement:

STATEMENT 2,

Showing the total produce of milk in thirteen States for the year ending June 30, 1860, and also the quantity used as food and the amount manufactured into butter and cheese for each State.

States.	Milch cows.	Total produce.	Used as food.	Manufactured butter.	Manufactured cheese.
	Number.	*Quarts.*	*Quarts.*	*Quarts.*	*Quarts.*
Maine	147,314	265,165,200	112,013,085	146,097,262	7,054,853
New Hampshire	94,880	170,784,000	75,052,328	86,959,550	8,772,122
Vermont	171,698	309,056,400	81,288,157	196,022,925	31,745,318
Massachusetts	144,492	260,085,600	135,555,626	103,724,200	20,805,774
Rhode Island	19,700	35,460,000	21,570,272	13,193,128	696,600
Connecticut	98,877	177,978,600	63,585,989	99,071,856	15,320,755
New York	1,123,623	2,022,521,400	543,030,641	1,288,695,987	190,794,772
Pennsylvania	673,547	1,212,384,600	553,828,525	648,697,450	9,858,625
New Jersey	138,818	249,872,400	109,868,653	139,287,811	715,936
Delaware	22,595	40,671,000	22,763,870	17,881,275	25,855
Maryland	94,463	170,033,400	96,286,486	73,714,130	32,784
Wisconsin	193,996	349,192,800	174,214,114	170,638,162	4,340,524
Virginia	330,627	595,128,600	405,561,119	188,463,968	1,103,513
Total	3,254,630	5,858,334,000	2,394,618,865	3,172,447,704	291,267,431

1. According to the above statistics fifty-four per cent. of the entire produce of milk is made into butter. The manufacture of this indispensable article of food has received the attention of our best chemists as well as of our most skilful manufacturers, and is now made in a very perfect manner. It is exported in large quantities and found in almost every port in a perfectly sweet condition. It is also kept fit for table use many months.

2. The dairy of the United States also produces an excellent quality of cheese, to the methods of the manufacture and care of which nothing need be added to the previous reports of the Agricultural Bureau. One point, however, cannot escape notice. In the thirteen above-named States the milk used in the manufacture of cheese is only about one-twentieth of the annual produce of milk, it being only five per cent. The cheese crop consumes only about one-eleventh as much milk as the butter crop. Its value is only about one-tenth as much.

3. We find also from the above table that forty-one per cent. of the annual produce of milk is consumed as food. A large proportion of this milk is consumed within a few hours after milking, but a much larger proportion, especially that for transportation, is kept for a considerable time. A much greater quantity would be sold could it be preserved a sufficient length of time to get it to market.

After making all allowances the consumption of milk as food is of much greater importance than its manufacture into cheese, and as our cities become more densely populated the difference will increase with the demand. Butter and cheese can be imported to any city, but the milk demanded as food must be produced within a comparatively short distance of the place of its consumption, unless there are railroad facilities for transportation. If conveyed by wagons, fifteen miles is about the extreme limit of cartage; but if conveyed by steam, either by boat or cars, one hundred and fifty miles is about the maximum limit.

The produce of milk as food in the vicinity of all large towns and cities must always therefore attract the especial attention of the agriculturist and abun

dantly reward his labors. It is also to be remarked that the cost of producing milk is much more expensive in the vicinity of large cities than in the country. The price of land, and, generally, the higher prices for food and labor, both tend to increase the cost of milk, while the slop feed, which is always furnished more or less by every city, and the movement of milk before it cools, tend to decrease the quality of the milk.

The following statement shows the comparative importance in which the three modes of consumption are held in each of the above-named thirteen States.

STATEMENT 3,

Showing the percentage of milk consumed as food and manufactured into butter and cheese; also the average produce, in quarts, to each person, and the average amount each consumed.

States.	Consumed.	Butter.	Manufactured cheese.	Average produce to each person.	Average consumed by each person.
	Per cent.	*Per cent.*	*Per cent.*	*Quarts.*	*Quarts.*
Maine	.42	.55	.03	422	177
New Hampshire	.44	.50	.06	524	230
Vermont	.26	.63	.11	980	255
Massachusetts	.52	.40	.08	211	110
Rhode Island	.61	.37	.02	203	124
Connecticut	.35	.56	.09	287	135
New York	.27	.64	.09	520	140
Pennsylvania	.46	.53	.01	417	192
New Jersey	.44	.55 +	.01 —	372	163
Delaware	.56 —	.44 —	.01 —	362	203
Maryland	.57 —	.43 —	.01 —	247	141
Wisconsin	.50	.48	.02	463	232
Virginia	.68 +	.31 +	.01 —	373	254

1. It is worthy of notice that but five States, viz: New Hampshire, Vermont, Massachusetts, Connecticut, and New York use over three per cent. of their milk for cheese, and that all south of Pennsylvania use less than one per cent.

2. Rhode Island, Massachusetts, and Maryland produce the least in proportion to their population.

3. Vermont, New Hampshire, New York, and Wisconsin produce the most in proportion to their population.

4. Massachusetts, Rhode Island, Connecticut, New York, and Maryland consume the least in proportion to their population.

5. Vermont, Virginia, Wisconsin, and New Hampshire consume the most in proportion to their population.

6. Virginia consumes as food nearly 70 per cent. of the entire milk product of that State; Rhode Island over 60 per cent.; and Maryland, Delaware, Massachusetts, and Wisconsin over 50 per cent. of the product of the States severally.

7. New York and Vermont manufacture into butter nearly two-thirds of thei entire milk product.

8. But one State, Virginia, uses less than one-third of its milk in the manufacture of butter.

9. Rhode Island uses the largest percentage in the manufacture of cheese; New York the largest percentage in butter; and Virginia the largest percentage as food.

10. Virginia uses the smallest percentage in butter and cheese, and Vermont the least percentage as food.

11. The average amount consumed daily by each individual, taking the whole thirteen States, is one pint.

12. The greatest average daily consumed by each person is 1.6 pint in Vermont and Virginia.

13. The least average daily consumed by each person is 0.6 of a pint in Massachusetts.

The amount consumed in the city of Washington is about 0.1 of a pint for each person.

THE PRESERVATION OF MILK.

In high latitudes, where the nights are damp and cool, milk can be transported for ten or fifteen miles without any special care, and be kept sweet for considerable length of time. This enables the inhabitants of cities and large towns to obtain their supplies from a large extent of territory. Competition is therefore free, and the price of milk is equitable for both parties, and so reasonable that every family finds it a cheap article of food. The preservation of milk in those latitudes is of minor importance. But as we pass southward the temperature increases, and the time that milk will remain sweet becomes less and less, till it is necessary, under present treatment, to use it almost as soon as it is milked. This, as a matter of course, limits the distance of transportation and the territory for the production of milk, thereby raising the price beyond the reach of many. In fact, most of the milk consumed in southern cities and towns is produced within their limits or immediate vicinity. The preservation of milk for a sufficient length of time to allow it to be transported fifteen, twenty, or one hundred miles, and keep sweet for twelve hours afterwards, would be an incalculable benefit to these places, by giving a greater supply and by allowing competition to reduce the price within the reach of all.

The present method of supplying the city of Washington illustrates the plan generally pursued in warm climates, and shows the time milk is kept before consumption.

The city of Washington is supplied in part by people residing within its limits. They keep from one to five cows each, and peddle the milk as soon as it is obtained—in the morning from six to nine o'clock, and in the evening from three to six o'clock. The milk is carried by hand in small tin cans, holding from four to sixteen quarts, and is not allowed to become quiet or time to cool.

Milk served in this manner in the months of December, January, and February will keep sweet about twelve hours, daytime, possibly twenty-four, including a cold night. In the remaining months it will, perhaps, keep three to eight hours in the daytime, and from twelve to sixteen hours including the night. During these months milk rarely cools below 50° Fahrenheit, and much more frequently is found above 70°. Keeping it in a refrigerator, or on ice, makes but little difference in the time it will keep sweet, *as the process of souring commences before the milk can be sufficiently cooled to prevent it.*

2d. In the suburbs of the city, not exceeding three or four miles distance, are a few milkmen who keep from ten to fifty cows, and peddle their milk from carts morning and evening. This milk is also peddled warm from the cow, and as a general thing does not keep sweet so long as that peddled by hand.

3d. A few milkmen reside from six to ten miles from the city, and milk their cows enough earlier to allow them to peddle their milk at the proper time. This milk, *being carted while warm*, is the least desirable of any sold in the city. In every case the cows are milked during the hottest part of the day, the most improper time that could be selected.

4th. The price of good milk is eight cents per quart the year round. In a few instances it may be had for six or seven in the summer and nine or ten in the winter. It is therefore taken in very small quantities by many families, and generally consumed as soon as obtained

The average amount of milk furnished to each person in the District of Columbia, including Washington, by the cows in the district outside of the city limits, *is less than a quarter of a gill a day.* The amount brought into the district from Maryland and Virginia, added to that produced by the cows within the city limits, *does not make one-half a gill as the total daily average consumed by each individual.*

Could milk be transported a hundred miles, and kept sweet forty-eight hours, thus opening the greater part of Maryland and a large portion of Virginia for the production of milk, the supply for this city would be abundant, and the price would allow every one to make it a substantial article of food, instead of being a luxury as it now is.

In contrast we present the methods of supplying

THE CITY OF NEW YORK.

About one-half of the milk consumed in this city is brought in by wagons, the remainder by railroads.

The following statements show the amount brought to the city by its principal railroads for each month in the year, the amount received at each station, and the distance of transportation.

STATEMENT 4,

Showing the quantity of milk received in the city of New York, at the depots of the Harlem, Erie, and Long Island Railroad Companies, for the year ending June 30, 1861.

Months.	Harlem railroad.	Erie railroad.	Long Island railroad.	Total.
	Quarts.	*Quarts.*	*Quarts.*	*Quarts.*
July	2,816,720	2,743,750	282,530	5,843,000
August	2,657,150	2,636,880	286,250	5,580,280
September	2,399,410	2,225,800	265,190	4,890,400
October	2,320,610	1,959,740	269,890	4,550,240
November	2,057,570	1,715,128	267,890	4,040,588
December	2,068,320	1,564,670	262,660	3,895,650
January	2,061,730	1,547,630	260,010	3,869,370
February	1,853,080	1,474,150	266,740	3,593,970
March	2,169,590	1,788,910	275,840	4,234,340
April	2,203,010	1,944,770	286,180	4,433,960
May	2,436,800	2,320,670	301,900	5,059,370
June	2,463,090	2,492,510	301,650	5,257,250
Total	27,507,080	24,414,608	3,326,730	55,248,418

The maximum daily rate by the month, 188,484 quarts, was delivered in July.

The minimum daily rate by the month, 124,871 quarts, was delivered in January.

Thirty thousand six hundred and ninety-four cows are required to supply the milk transported over these railroads.

The average cost of transportation is $552,484 18 annually. This includes the return of the cans.

The average cost of the milk, as it is received for transportation, is $1,104,968 36 annually.

STATEMENT 5,

Showing the quantity of milk received in the city of New York, from each station on the Harlem railroad, for the year ending June 30, 1861.

Stations.	Quantity received from each station.	Distance from N. Y. city.
	Quarts.	*Miles.*
White Plains	86,310	23
Kensico	21,530	26
Unionville	88,250	29
Pleasantville	135,150	31
Chapequa	190,960	33
Mount Kisco	689,060	37
Bedford	859,060	40
Katonah	1,794,370	42
Golden's Bridge	1,476,850	44
Purdy's	2,092,090	47
Croton Falls	1,799,310	48
Brewster's	3,787,460	53
Dykeman's	872,930	55
Towner's	2,227,780	58
Patterson's	1,983,700	61
Pawling's	1,496,730	64
South Dover	808,710	70
Dover Furnace	298,780	75
Dover Plains	605,750	77
Wassaic	1,407,850	82
Amenia	1,966,820	85
Sharon	205,470	88
Coleman's	529,820	90
Millerton	1,822,430	93
Boston Corner	194,680	100
Chatham	62,230	128
Total	27,507,080	.....

STATEMENT 6,

Showing the quantity of milk received in the city of New York, from each station on the New York and Erie railroad, for the year ending June 30, 1861.

Stations.	Quantity received from each station.	Distance from N. Y. city.
	Quarts.	*Miles.*
Turner's	932,016	47
Monroe	2,524,560	50
Oxford	1,875,844	52
Chester	4,852,048	55
Washingtonville	864,452	60
Goshen	4,017,192	63
Hampton	2,719,768	64
Middletown	2,618,048	67
Howell's	2,235,200	71
Otisville	1,108,520	76
Total	23,747,648	.....

The discrepancy between the total amount in the above statement and that in No. 4, arises from the fact that a few small stations were not reported in the above.

In 1847 this railroad company transported less than 15,000,000 quarts of milk over their road. In 1861 they carried nearly 25,000,000 quarts.

STATEMENT 7,

Showing the quantity of milk received in the city of New York, from each station on the Long Island railroad, for the year ending June 30, 1861.

Stations.	Quantity received from each station.	Distance from N. Y. city.
	Quarts.	*Miles.*
Willow Tree	75,650	12
Brushville	58,400	16
Hyde Park	131,400	18
Hempstead	930,850	22
H. Branch	80,300	20
Westbury	1,087,700	22
Hicksville	344,100	26
Syossett	441,650	30
Jerusalem	76,680	28
Total	3,326,730	.....

The milk which is received in the city by these railroads is all of it kept 24 hours, most of it 36, and some 48 and even 60 hours, before it is used, and yet remains perfectly sweet. The act of transportation, even for a hundred or a hundred and fifty miles, does not seem to injure it. Charles Menot, general superintendent of the Erie Railroad Company, in a letter on the subject of the transportation of milk, says: "The favor with which Orange county milk is met in this city, (New York,) demonstrates that the transportation does not injure it."

On the Harlem railroad, at the distance of a hundred miles from New York city, the movements of milk are as follows: Suppose the cows are milked about 7 o'clock *Monday afternoon*, and again at 5 o'clock *Tuesday morning;* this milk, both the night's and morning's, is carted from one to four miles to the depot, in open wagons, Tuesday from 3 to 4 o'clock in the afternoon. It then takes the cars, and in the milk train reaches New York about 4 o'clock *Wednesday morning*. One-half of the milk, that was milked Monday night, is 36 hours old, and the remaining part 24 hours old. Of this milk that which goes to the retail trade is consumed *Wednesday*, but that to the wholesale dealer is frequently kept till Thursday, perfectly sweet.

The milk brought to the city by wagons is conveyed to customers so soon as milked, and receives no special care from the producer, except so far as to dispose of it as soon as possible. It is nearly, if not all, consumed within a few hours after it leaves the dairy. It cannot keep, under the most favorable circumstances, but a few hours after it is distributed.

The consumption of milk must be much less in cities than in rural districts. It falls considerably below the average amount, taking the entire population of

the country. The general daily average to each individual in the thirteen States before named is *one pint.* The general average in the District of Columbia, including Washington, is less than *one-half a gill.* Estimating the average in New York city at *one-half a pint,* which is a large estimate, the railroads supply over 600,000 people with the best milk consumed within its limits.

The contrast which the above methods of supplying cities with milk present suggests the pertinent inquiry, why is it that milk furnished by railroads keeps sweet so much longer than that furnished by other methods? The answer is obvious. On the one hand, milkmen that do their own transportation own teams for that special purpose, and so regulate the hours for milking that they may save themselves as much trouble as possible and be in market at proper times with their milk. *Therefore, in most cases, they cart it warm.* It is strained from the milk-pail into the cans, and is all disposed of before it has time to cool.

On the other hand, milkmen that depend on railroads for transportation cannot send their milk at will. The train goes but once a day, and therefore *it is absolutely necessary for them to take some means to preserve their milk.* There is no necessity for milking in the heat of the day, or of hurrying milk to market before it is cool. Milking can be done at the best time, morning and evening.

In short, the answer is, in one case *care is taken to preserve the milk,* and in the other *care is* NOT TAKEN *to preserve it.*

METHODS OF PRESERVING MILK.

1. By heat.
2. By evaporation or condensation.
3. By cold and quiet.

1. *Heat.*—There are two methods of preserving milk by heat.

First. By heating it in the open air. This is very commonly resorted to under the name of scalding the milk. Several years since Gay Lussac demonstrated that if milk be heated gradually to boiling point two days in succession in the winter, and three in the summer, it would keep two months without souring.

Second. The milk is first bottled up tightly with wired corks and placed in kettles of cold water. The water is now gradually heated to boiling point when the kettles are removed from the fire and allowed to cool. The bottles are then taken out and packed for future use. Milk treated in this manner will keep for six months. It has been claimed that the addition of soda or hedge mustard has a good effect, but it is believed that the real preservative power is the heat.

By these methods the milk loses its primitive taste, and is not suitable for many purposes, nor can they be practically employed by dairymen supplying our cities.

2. *Evaporation or condensation.*—This process was patented a few years since, and consists in evaporating the watery portions of the milk till it solidifies. It is then put up in sealed tin cans and can be carried to all parts of the world. It keeps sweet a great length of time, and is used most extensively by people at sea. There are several large manufactories in Connecticut and New York which have been in operation for several years. The particulars of the process are not known to the public.

3. *Preservation by cold and quiet.*—This is the process practiced by dairymen generally, who are compelled to send their milk to market by the cars.

The process consists in cooling the milk to about 40° Fahrenheit, as soon as possible after milking, and in keeping it at that temperature, in perfect quiet, till it is ready to be carried to the cars.

The essential requisite is a spring of cold water. The quantity of water is not of so much consequence as its degree of coldness and its permanency. The water should be conducted underground the shortest possible distance to a suita-

ble place for the location of the milk-house. This place, if possible, should be on the north side of a hill, well shaded, and so situated that the water from the tank will readily flow off. The house should be of such size and form as to admit of a tank two feet wide, and of sufficient length to hold all the milk-cans. The depth of the tank should be about four inches less than the depth of the can. Each can should have a separate division, and the divisions so arranged that the water may pass from one to another.

The water from the spring should enter at the bottom of the first division, and from the top of the first enter the second, then from the bottom of the second enter the third, and so on, alternately entering at or near the top of one and the bottom of the next division. This secures a perfect current around each can, particularly if the top entrances are at the back side of each alternate division and the bottom entrances at the front side of the tank.

The tank should be so arranged as to be out of the way of any currents of air. The ventilation of the house should be only sufficient to keep the air pure. Most milk-houses admit altogether too much air. In all cases, all ingress of air to the house should be prevented as soon as a thunder shower is seen rising, and no admittance allowed till the milk is to be removed. In clear or in rainy weather the ventilator may be open, but never in showery weather.

Ozone, which is freely generated by electricity, acts energetically on milk, souring it in a few minutes, many times destroying the milk before the shower has passed over. Therefore, all air from the vicinity of thunder showers, which always contains ozone, should be carefully excluded from the milk-house.

Having prepared a place for the reception of the milk, its treatment remains to be considered.

The cows are milked in the cool of the evening, just after sunset, and the milk is strained into the cans which are to convey it to market. These cans hold about forty quarts, and when filled weigh about one hundred and twenty pounds. They are made of strong tin, and are well bound. As fast as the cans are filled they are placed in the tank, beginning at division No. 1. The cans remain uncovered, and the milk is not allowed to be stirred or even jarred.

The tank should be so constructed as to be disconnected with the building. It should rest flat on the ground, so that any jar of the building cannot disturb the milk in the tank.

In the morning the cows are milked before sunrise, and the milk placed in the cans as before. If there is a can partly full of night's milk, it must remain so; the warm morning's milk must not be mixed with the cool night's, but kept separate. In no case must a can of morning's milk stand in the tank above a night's can, for in that case the warmth of the morning's can will be distributed over the night's milk, and the process of souring initiated.

At about 3 or 4 o'clock in the afternoon the milk is to be carried to the cars. The cans are then to be filled if necessary. The milk being all cool can be mixed; in fact, there is no difference between the night's and morning's milk. No parts of cans are to be sent to market, but to be *kept over twenty-four hours longer*.

The cans are then placed in a wagon and a wet covering spread over them, over which are thrown buffalo robes or other covering. At the railroad station the cans are closely packed in a closed car without anything being thrown over them, and during the night reach New York. "The rate of a night milk train when in motion is twenty miles per hour."

The cans are then taken by milk-carts, and the milk is distributed to consumers. The milk, therefore, does not leave the cans till it is sold, and generally it is disposed of at a temperature nearly as low as it left the milk-house. In this condition it will keep sweet twenty-four or even thirty-six hours, and is a pure country milk, quite different in value from that peddled at a smoking temperature of 70 or 80 degrees.

A similar process of cooling milk has been practiced several years. It has been thought necessary to stir it several times while in the tank to aid in cooling, but it is now, however, found that this treatment is highly injurious. The milk should be kept as still as possible till cooled to about 40° Fahrenheit, or below, when it may be stirred or transported to a great distance without injury, provided the temperature is not elevated.

The above process is that practiced on the Harlem railroad during the hot months. Not so much care is necessary during cool weather. The water, however, is always kept running, and the milk-houses kept patterns of neatness. The cans are cleansed with boiling water and sand after returning from the trip. The cost of transportation averages one cent per quart; the producers sell it, delivered at the station, for two cents; therefore *it costs, ready for delivery in New York city, three cents per quart.* Usual retail price six cents.

This process is available and practicable for all milkmen. The milk should be cool in all cases before carting it. Milk that is not cooled commences decay in a few hours after milking, and is not a healthy diet. Sour milk is not so injurious. It is milk that is in a state of change that is unhealthy.

No food should be eaten while a chemical change is going on among its constituents.

The plain suggestion, then, is to have milk cooled before it is offered for sale. Milk in the evening and peddle it in the morning, and sell the morning's milk in the afternoon.

In this manner the territory around our large towns and cities for producing milk will be greatly enlarged, and milk may become an important article of food.

THE VALUE OF THE MILK CROP.

The value of the milk crop may be very fairly estimated from the value of milk used in the manufacture of butter. Fifty-four per cent. of the entire crop in the thirteen States before named is made into butter; hence, the value of butter forms a very correct basis for ascertaining the true value of milk. In the following table the prices of milk given for each State have been derived by taking the average prices given for the cost value of butter at the places where it is made, and extended over a period of twelve years. The localities were selected from various sections of each State. This method was pursued with all the States except Wisconsin, which extended over a period of only three years.

I am aware that these values, with the exception of Delaware, fall below the generally estimated value of milk; yet I am confident that if there is any variation from the true value it is that I have overestimated them. *The value of milk in the United States will average less than one cent and five mills per quart.*

The following is a correct statement of the value of milk per quart, the total value of the crop, together with the value of the amount consumed in each of the named States.

STATEMENT 8.

States.	Price per quart.	Value consumed.	Total value.
	Cents.		
Maine	1.36	$1,523,377 96	$3,606,246 72
New Hampshire	1.44	1,080,753 52	2,459,289 60
Vermont	1.28	1,040,488 41	3,955,921 92
Massachusetts	1.68	2,277,334 52	4,369,438 08
Rhode Island	1.64	353,752 46	518,544 00
Connecticut	1.60	1,017,375 82	2,847,657 60
New York	1.36	7,385,216 72	27,506,291 04
Pennsylvania	1.28	7,089,005 12	15,518,522 88
New Jersey	1.76	1,933,688 29	4,396,754 24
Delaware	2.00	455,277 40	813,420 00
Maryland	1.20	1,155,437 83	2,040,400 80
Wisconsin	1.48	2,578,368 89	5,160,053 44
Virginia	1.12	4,542,284 53	6,665,440 32
Total	.....	32,432,361 47	79,857,980 64

1. Milk is worth the most in Delaware and the least in Virginia. The small extent of the territory of Delaware, and its proximity to market, will readily account for the high price of its milk crop.

2. New York produces as much milk in value as the six New England States, together with New Jersey, Delaware, and Maryland.

3. New York and Pennsylvania produce more milk than the eleven remaining States, and nearly one-third the entire crop of the United States.

4. It is remarkable that Maine, New Hampshire, Vermont, Connecticut, New Jersey, and Maryland consume about the same amount in value. Pennsylvania consumes nearly as much as New York, although she produces but little more than half in value.

5. The value of milk seems to be determined by its proximity to market. It cannot be transported under the present treatment like many other articles of produce.

With the above tables as a basis, it is estimated that the entire milk crop of the United States for the year 1860 exceeded $160,000,000.

Amount consumed as food	$90,000,000
Amount manufactured into butter	65,000,000
Amount manufactured into cheese	5,000,000
Total	160,000,000

The above is the cost of the milk. The additional value produced by the manufacture and transportation of butter and cheese will make the value of the dairy of the United States for the year 1860 exceed $200,000,000.

This estimate is made on the value of milk at 1.48 cent per quart. Should the common estimate of two cents per quart be adopted, the value of the dairy will be upwards of $260,000,000.

This estimate is also made on assuming the average produce of each cow to be 1,800 quarts of milk. Should the average annual produce of cows be raised to 2,200 each, as it ought to be, the value of the dairy products of the country would be about $320,000,000.

COTTON IN MISSOURI.

BY W. H. HORNER.

For the last five or six years cotton has been successfully raised in Missouri,* with ordinary cultivation. As yet, the farming community have not hit upon the best mode of its culture. Owing to the richness and peculiarity of the soil and I may add climate and atmosphere, it is evident that cotton requires a different mode of cultivation than in other sections of the country. Cultivating too much will make it grow too fast, thereby producing stalks from shoots and branches, lessening the quantity and quality of bolls, procrastinating their maturity, whereby, early frosts setting in, the yield is short of an average crop.

The most approved mode of cultivating cotton in this section of the country is, to prepare your land early, any time from the 1st to the 20th of April, with a two-horse plough, and run two furrows, throwing the earth together, forming a ridge. The two furrows should be run so close to each other as to leave unbroken a portion of the soil in the centre of the ridge, a space four or six inches. Make the rows or ridges not less than five feet apart. After this a wooden plough, somewhat in form like the old-fashioned shovel plough, (with one horse,) is used; with this open the centre of the ridges, if possible, down to the unbroken earth. It is better to let it remain in this condition, if time will admit, until there falls a beating rain, in order to give compactness to the earth, which is very necessary in an open, sandy soil, like this.

Then the cotton seed is sown or drilled in the furrow made by the wooden plough. The next step to be taken is to cover the seed, which is done by another arrangement. A small trough is made, open at one end, with the trough side down, on the top of which is fastened a beam and handles, similar to that of a plough; this affair being also drawn by one horse. The trough should be about two and half feet long and about eight to ten inches wide, so constructed that the open end should go before. This is run over the ridges or drills; in that way the seed is covered and the coarser particles of the earth are pulverized and packed over and about the seed. The next step to be taken is to break or plough up the land between the drills or rows, which may be delayed until the cotton needs working, and then it may be done with an ordinary turning plough, except next the cotton, which should be done with what is called a scraper, made expressly for the cultivation of cotton. This scraper may be so adjusted, by a sliding arrangement, that it can be run within any desirable distance of the young cotton, and to any depth necessary to the complete removal of weeds, which does it effectually. When the cotton requires a second working, the scraper is run again on each side and near the cotton, followed with hoes for the purpose of removing all remaining weeds and grass, and to thin the cotton where it is too thick. When the third working is required, a one-horse plough is used, throwing the earth to the cotton for the purpose of covering small weeds and grass, and give the cotton a thrifty growth. The hoes are again brought into requisition for the same purpose as before. This is the last time the cotton is thinned. It is now called a stand. After this the main object is to keep the ground clear of weeds and grass, and not cultivate the cotton to hasten its growth, otherwise it will grow too late in the season, producing a crop of bolls inferior in quantity and quality. The sooner cotton is stopped from growing in stalks and branches, the sooner it blossoms and matures, yielding also a much larger and

* The monthly mean of the thermometer is higher than at other points on the same parallel.

better fibre. In favorable seasons and early planting, it is usual to have blossoms the latter part of June or the first of July. Wet and rainy seasons are not so favorable to cotton as dry ones. In wet seasons it continues to grow and does not mature well, favoring the growth of weeds and grass, which, by all means should be kept down. One hand, by the mode just pointed out, can cultivate ten acres in cotton and five in corn at the same time, as the picking season does not come on until the fall of the year, when the farmer is through with his other work and his time is exclusively occupied in picking his cotton and gathering his corn. If more attention were paid to the cultivation of cotton here, and less to corn, my opinion is that farmers would do much better, bringing more money into the country in one year, with like amounts of capital invested, than from corn in three years. Take, for example, the product of one hand, and allowing that one hand can cultivate ten acres of cotton and five of corn at the same time, and one hand can cultivate in corn alone, twenty acres.

In the first place, the average yield of cotton here is about 1,500 pounds to the acre.

One hand will work say ten acres, making 15,000 pounds seed cotton, which, at a value of 2¼ cents per pound in the seed, would amount to	$337 50
Five acres in corn, say 50 bushels to the acre, is 250 bushels, worth here 25 cents a bushel, making	62 50
Total product of one hand being	400 00

Now we will foot up the cost of producing the above, and we have:

Rent for 15 acres of land, at $2 per acre	30 00
Hire of one hand three months, at $15 per month	45 00
Hire of work animals, same time	20 00
Feed for animals	5 00
Board for hand three months, at $8 per month	24 00
Wear and tear of ploughs and gear	6 00
For picking cotton, a half a cent a pound	75 00
Gathering five acres of corn	5 00
Total cost for producing	210 00

Thus we have as profit from the product of one hand, the sum of one hundred and ninety dollars, ($190,) being a profit of nearly one hundred per cent., with everything to rent and hire, and selling at home prices. Suppose the producer owned the land, horses, hands, and everything necessary for farming, and adding expenses only for wear and tear, feed, &c., would not that increase the profits above the foregoing calculation? My opinion is that it would add over twenty per cent. I am satisfied, too, that there will be an improvement in the amount of product upon the same amount of land in years to come. As yet, cotton raising is in its infancy here, and the crop will improve in quantity as the farmers acquire experience, inasmuch as cotton requires a different mode of cultivation in this soil from that of any other section of the country. We will now see what the profits here are from the product of one hand, in corn.

One hand will work in corn 20 acres.

Allowing 50 bushels to the acre, 1,000 bushels, worth here 25 cents per bushel, will foot up the sum of $250.

The cost of producing which will be as follows:

Rent for 20 acres of land	$40 00
Hire for one hand for three months, at $15 per month	45 00
Hire of work animals	20 00

Feed for animals	$5 00
Board for hand, at $8 per month	24 00
Wear and tear of ploughs and gear	6 00
Gathering 20 acres of corn	20 00
Total cost for producing	$160 00

Showing a profit of ninety dollars, and a difference of profit in favor of cotton of over one hundred per cent. Cotton has the advantage over corn in cheapness of transportation. A boat that will freight two thousand bushels of corn, will cost, when ready for freighting, $200, and the 2,000 bushels of corn will weigh 112,000 pounds, which would be for corn and cost of boat, $700. Expense of hands and getting to market $100, making the sum of $800. Suppose the 2,000 bushels of corn bring in market 60 cents per bushel, it will amount to $1,200. Then suppose the same boat will freight in cotton half as many pounds as in corn, and we have 56,000 pounds ginned cotton, worth in market, say at Memphis or New Orleans, 10 cents per pound, we have the value of one boat load of cotton, amounting to the sum of $5,600; thus showing an advantage in favor of cotton all the time, both to the producer and shipper.

We have navigation for flatboats at least six months in the year, and for steamboats about three. The cost of getting to market from this place to Memphis is about forty cents on the hundred pounds, and about the same to New Orleans. The facilities for building boats here are good, and boating on Little river and the St. Francis is both practicable and safe. Thus taking everything into consideration, there are more inducements held out in this country for its settlement and farming than any other; more advantages and less disadvantages. No overflow from rivers to contend against, and as fine soil as is in the world, easy of cultivation. Both soil and climate are well adapted to all the various products that are desirable to raise in latitudes north and south of this for a considerable distance—cotton in particular; it is as certain in yield (while being fluctuating in price) when properly planted and cultivated. The farmer may calculate his points almost to a certainty. The plant is not subject to any of the diseases of other parts, such as rust or boll-worm. It grows healthy from the time it gets above ground to its maturity, and the fibre is of a finer quality than that raised in the States of Mississippi or Tennessee.

ON THE DESTRUCTION OF NOXIOUS INSECTS

BY MEANS OF THE "PYRETHRUM WILLEMOTI" DUCHARTRE.*

TRANSLATED FROM THE FRENCH BY C. WILLEMOT.

Of all substances hitherto proposed for the destruction of noxious insects, powders have been found the only ones that can be used to advantage on account of their simple and easy method of application. All such powders,

* See also the article on the "Persian insect powder" in the Agricultural Report for 1857, translated and condensed from the *Wochenblatt für Land- u. Forstwirthschaft*, 1856, p. 256.

too, which have been employed, so far as are known, are derived from the vegetable creation.

It would occupy too great a space to enumerate here all the plants used in the form of powder for this purpose; it will suffice to mention some which have been more particularly under observation. Among these are the straight-leaved pepperwort, (*Lepidium ruderale*, of Linnæus, and *Thlaspi ruderale*, of Desfontaines,) found growing in uncultivated places and among rubbish around Paris. This is used in Southern Dalmatia, in the form of powder, almost exclusively for the destruction of fleas. In some parts of Southern Russia, especially in the Crimea, a plant very common in France, *Aristolochia Clematitis*, Linnæus, (common birthwort,) is used exclusively to destroy bugs. Sawdust of aromatic wood, particularly American cedar, (*Cedrela odorata*, L.,) is largely sold for the destruction of insects, and, according to some professional man, most of the powders sold in Paris for that purpose are composed of that substance. But after using and experimenting with them we have been fully convinced that the object cannot thus be perfectly attained. Their action is feeble, or they merely stupefy for a time the insect, which soon recovers its strength and ability to do injury.

The greater number of the plants which furnish the most satisfactory means for the destruction of insects are of the genus *Pyrethrum*. Many observers, considering the botanic resemblance (as well as similar properties of this genus) with kindred ones, as certain chamomiles, the *Anthemis cotula* for instance, have pretended that such indigenous plants (chamomiles) may specifically furnish a powder for destroying insects, equal in every respect to the *Pyrethrum*. But accurate and detailed experiments by ourselves and other competent observers refute such assertion. All the efficacy of the *Anthemis cotula* consists in rendering the insects insensible for a time instead of destroying them.

The inhabitants of the regions of Europe and Asia, near the Caucasian mountains, seem to have been the first to discover the properties of the *Pyrethrum* and try on a large scale the powders obtained from these plants. The species employed differ according to the different localities. It is easy to comprehend that the inhabitants of the Caucasus choose for their use that kind which is most abundant in their own country. Thus in Armenia they prefer the red or rosy Pyrethrum, (*Pyrethrum roseum*, Biebers,) commonly called *Lowizachek* or flea-plant.

The Persian powder which appears most extensively used is almost wholly composed of the flesh-colored Pyrethrum, (*Pyrethrum carneum*, Biebers.) Dr. Ch. Koch, in his Travels in the East, gives very curious details respecting this precious species in the Caucasian regions. In the *Journal de la Société Impériale et Centrale d'Horticulture de la Seine*, vol. III, 1857, page 756, may also be found an analysis of a note of Mr Neumann, of Breslau, on the culture and preparation of the powder of the *Pyrethrum carneum*.

We may here remark, in passing, that in countries where the most frequent use has been made of these powders of *Pyrethrum*, they have only been applied to the destruction of insects which are troublesome in dwellings. Our object has been to select from the different plants the one which presents the greatest range of efficacy; and we have been more exacting herein than heretofore has been the case, seeking a plant of incontestable efficacy for the destruction of insects, and which can be so applied not only to vermin in the house, but also to those insects which every year commit so great ravages upon the cereals, fruit trees, pod fruits, ornamental plants, &c. A plant was desirable which can easily be acclimated in France, the properties of which, in its wild state in its native regions, are neither destroyed nor weakened by cultivation, and which can be raised with but slight attention to its culture. We want, finally, a productive plant, to the end that the powder it furnishes may be sold at a very

low price Such a plant we are now fortunate enough to introduce for the public use.

Its efficacy has been fully proved by a great number of persons, as will be seen hereafter; its acclimation is very satisfactorily evinced; its culture is most simple; its properties are wholly retained; the production is very abundant; and now nothing remains but its extensive propagation, which, indeed, is not without its many difficulties. We will not disguise the fact that the great success so far attained by no means makes us suppose our task as accomplished; but, nevertheless, it encourages us to continue our efforts with new perseverance.

It was about 1850 when the first powder of Pyrethrum was introduced into France for the destruction of insects in houses. The powder came exclusively from provinces of the Caucasus, of Persia, and Dalmatia. Our researches have proved to us that that from the Caucasus is the best. For a number of years the inhabitants of those countries have successfully used the powder of the Pyrethrum, and insured themselves against the ravages of numerous insects.

But, we repeat, they only had a very limited knowledge of their plants, and did not suspect that one among them, the *Pyrethrum of the Caucasus*, (*Pyrethrum Willemoti*, Duchartre,) would be called upon to render the most effective service to agriculture, horticulture, achieving the preservation of food, wool, furs, and the comfort of the domestic animals, &c.

These powders had been introduced into France for several years before a choice had been made among them, and the special importance of the one above named had been recognized. The high price and the numerous adulterations they have undergone diverted the public from this acquisition and from a full appreciation of its efficacy. Submitted to a close analysis, these powders as sold have been found to be mixed with dangerous substances, which a due regard to public safety requires to be rigorously excluded from sale. In them sumac powder has been detected, which presents a striking resemblance to the powder of Pyrethrum; and also jalap, cockle of Levant, nux vomica, and even arsenic, enter into the composition of the powders we have examined. Let us hope, however, that the Board of Public Health has since prohibited the sale of these adulterations, by which great mischief might be done in domestic economy.

In 1855 our researches were successful in finding out the truth as to these insect-destroying powders, and we fixed our choice upon the exclusive use of the powder of the Pyrethrum of Caucasus. Encouraged by this result of our investigations, we determined to obtain a large quantity of the Pyrethrum, gathered and dried with the utmost care. For this purpose we made application to a resident of Tiflis, in Georgia, where it grows abundantly, as well as in the neighboring regions. He willingly became interested in our plans, and paid the strictest attention to all the recommendations necessary to the introduction of the plant into France. Four months after we received from Tiflis a bale of this so much desired species of Pyrethrum, and in a state of gathering and preservation most gratifying. Then began our really serious endeavors, and our experiments were prosecuted to a considerable extent. We at once became acquainted with the efficacy of the powder of this plant for the destruction of insects in dwellings; but our long-protracted observations taught us that weevil, caterpillars, plant-lice, and a multitude of other insects of our cultivations and gardens, could not resist the effect of our powder. We can emphatically say that not a single species experimented on could do so; which fact gives us the certainty and the conviction that it will be for France a new source of wealth to have a plant which can at once render great services to agriculture, commerce, and domestic economy.

It was not till 1856, after many efforts, we could procure some good seeds of the Pyrethrum of Caucasus. We could then extend our researches as to the culture of the plant. We had to proceed cautiously in determining the soil best

adapted to it, to find out the best exposure, and finally to discover all the care necessary to be bestowed on it. The first sown on September 15, 1856, produced only a few shoots. A great point with us was to ascertain whether the plant was an annual or perennial one. In order to determine this important question we had several of the procured plants pass through the winter of 1856 and 1857, and we were agreeably surprised to see them sustain from eight to twelve degrees of cold without appearing to suffer. Rejoicing in this result, we spared no pains nor labor, and the seeds gathered from that first culture were sown in February, 1858. In May we communicated our experiments and the success that crowned them to Messrs. Decaisne, Neumann, and Pépin. These gentlemen then examined our plant botanically, and their opinions are as follows:

BOTANICAL CHARACTERISTICS OF THE PYRETHRUM OF CAUCASUS.

The genus *Pyrethrum** has been established by Gaertner, according to Haller. Linnæus classes it under the genus *Chrysanthemum*, but it differs from the latter by the strap-shaped flowers or semi-florets situated on the circumference and terminating by three teeth, and because its fruits or akènes are crowned by a projecting membrane, frequently toothed. It must be admitted that these characteristics are not always very distinctly marked in some of the numerous species composing the *Pyrethrum*, and that the other characteristics of these plants resemble in every respect those of the *Chrysanthemum*. However this may be, present authors unanimously adopt the genus *Pyrethrum*. It belongs to the great family of the composite plants in the tribe of *Senecciones* and the subdivision of *Anthemideæ*.

After the introduction into France (session of the Imperial and Central Society of Horticulture of October 22, 1857) of the first shoots of the species dwelt upon in this paper, there was quite a long period of indecision as to the true name which was to be given to this plant. On its presentation to the Horticultural Society it was regarded as *Pyrethrum roseum*, Biebers, (Chrysanthemum roseum, Adam;) but at that time the character of the plant not being perfectly ascertained, this decision could only be the result of a supposition. Later, when we presented some flowering samples of the plant to the museum, Mr. Decaisne, believing that he was examining a plant well known to the botanical explorers of the Caucasus, and described in botanical works on that region, at first sight took it for *Pyrethrum pedunculare*.

A little afterwards, having inspected the herbariums of the museum, the celebrated professor recognized only one species to which it could be compared. Unfortunately the dried specimen which he was examining being quite incomplete, his researches were necessarily limited, and Mr. Decaisne regarded our plant as belonging to the species named by Fisher and Meyer *Pyrethrum elongatum*, (*Tanacetum elongatum*, Schultz, Bip.,) which he, with much kindness, communicated to us. Thus the Pyrethrum of Caucasus was propagated under this name to the time when Mr. Duchartre, having made it a special object of study, declared (session of the Horticultural Society, November 24, 1859,) that this kind never before was described, and that it differed by very marked characteristics from the *Pyrethrum elongatum*. The conclusions and scientific reasons inducing Mr. Duchartre to establish a new species for our plant are given in the fifth volume of the *Journal de la Société Impériale et Centrale d'Horticulture*, p. 211, where his learned observations in relation to it will be found.

We quote here only the conclusion of the letter of dedication which the author has so kindly addressed to us:

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* The name is a Greek word, signifying "fire," because the first plant of this name had a root which, when chewed, leaves a very burning taste in the mouth; it is a species of chamomile (*Anthemis pyrethrum*) used in medicine.

"I believe, then, at last," he writes, "that I am sufficiently justified in considering this (our species) as a new one, and this being the case, I hope that it will not be thought I do more than justice in giving to it a name which will remind us of Mr. Willemot, to whom is due its introduction into Europe."

The Pyrethrum of Willemot, (*Pyrethrum Willemoti*, Duchartre,) commonly called Pyrethrum of Caucasus, is a perennial herbaceous plant which in its cultivated state reaches to the height of about 0.50 to 0.60 metres. All its green portions are covered with soft, cottony hair, giving it a whitish appearance. It forms rounded tufts, in the middle of which shoot up numerous little heads of flowers with long peduncles. The stalk is erect, nearly frutescent, rounded below, striped or furrowed, a little cottony towards the top. The lower leaves are large, and measure often 0.20 metres (nearly eight inches) in length, by a breadth of 0.05 metres, (nearly two inches.) Borne by a long channelled petiole, slightly clasping at their base, they are divided into seven to nine segments, or pinnatifid. These segments are alternate, deep, narrowed at their base, expanded at their top in unequal lobes, terminated by pointed teeth. In proportion as they rise on the stalk the leaves become smaller and less divided. Some of them, towards the top, may even be found linear and almost entire. The leaves, finally, vary in their form during the course of vegetation. They have a very bitter taste. The peduncles are furrowed or channelled, and have hardly any but small linear leaves, and near the head (capitulum) very small green scales. The little heads formed by the reunion of the flowers on a common receptacle terminate each in a peduncle. They present a diameter of 0.04 to 0.05 metres. The flowers of the disk are yellow, and those of the circumference or rays are white. The involucre or common calyx is composed of scales, brownish towards the middle, and covered with a cottony and whitish down. They are imbricated linear, the exterior ones are longer and terminate in a point, the interior ones, on the contrary, are truncate, curved, and terminating in irregular teeth. The receptacle is nearly hemispherical convex, without the spangles, (which are found in many other plants of the composite family.)

The flowers of the circumference, which are also called strap-shaped flowers or flowerets, have a corolla with a short tube and a tongue-shaped limb, presenting two furrows above and terminated by three rounded teeth. Each little head is composed of from twelve to fifteen of these flowers. The flowers of the disk, (those which are yellow and situated in the centre,) named also flowerets, have a corolla, hollowed regular, divided at the top in five large teeth, and presenting on the external surface small grains. In cutting the corolla, as has been done, we may see the sexual organs.

The five stamens have their anthers united in a tube, each terminating by an appendix, which results in the prolongation of the connexion in the form of an oval tongue. The threads are slender and abruptly inflated near the anthers.

The style presents at its basis an inflation in the form of a bulb, crosses the tube of the stamens, and terminates in two developed branches with stigmas. The flowers on the circumference are female, that is, they enclose only the pistil, the stamens being represented only by five little distinct thread-like bodies inflated with a rounded head at the extremity.

The ovary of the flowers of the disk, as well as of the flowers of the circumference, is inferior, that is, other parts of the flower are inserted at the top, slightly arched and marked with five longitudinal angles, alternating with the teeth of the corolla. The ovary, the form of which is thus somewhat prismatic and surmounted by a border forming a cup irregularly toothed, and constituting what is termed egret, because in many compound flowers that part forms a silky assemblage.

The external side of the ovary is flat in the flowers of the circumference, whilst in the flowers of the disk it forms a projecting corner. Thus the portion of the sections of the ovary, situated at the bottom, relates, for one as well

as the other, to the exterior of the flower. The hollow of the ovary is filled almost entirely by an erect ovule inflated at the top and turned back or reflexed.

The fruits or akènes, which succeed the ovaries, are a little more arched than the last, presenting between their five sides small resinous grains. Their egret, as we have termed it in speaking of the ovary, is composed of a sort of a cup, which does not reach scarcely the sixth or seventh part of the length of the fruit or akène.

CULTURE AND GATHERING.

The Pyrethrum, though a native of Mount Caucasus, where it grows abundantly, and at a slight elevation above the level of the sea, under a latitude warmer than that of Paris, succeeds very well on good soil in our climate. It is very hardy, and can sustain, without hazard, our severe winters. A four years' experience has taught us that it is little sensible to cold, and that it needs no shelter during the winter. It has been asserted that the kindred species, which also grow in the Caucasus, have rather suffered than been benefited by the shelter, when given them. This assertion makes us think that it must be so likewise with the Pyrethrum of Caucasus.

The soil best adapted to the culture of the latter should be composed of a pure ground, somewhat silicious and dry. Moisture and the presence of clay is injurious, the plant being extremely sensitive to an excess of water, and would in such case immediately perish. A southern exposure is the most favorable. The best time for putting the seeds in the ground is from March to April. It can be done even in the month of February, if the weather will permit it. After the soil has been prepared and the seeds are sown, they are covered by a stratum of ground, mixed with some vegetable mould, of about 0.02 metres thickness, when the roller is slightly applied to it. Every five or six days the watering is to be renewed, in order to facilitate the germination. At the end of about thirty or forty days the young plants make their appearance; and as soon as they have gained strength enough they are transplanted, at a distance of about 0.15 metres from each other. Three months after this operation they are transplanted again, at a distance of from 0.35 to 0.50 metres, according to their strength. In following this method we have raised shoots which, together with their leaves, reached 1.50 metres in diameter. It is superfluous to mention that each transplantation requires a new watering, which, however, even in the hottest weather the Pyrethrum of Caucasus can sustain, should only moderately be applied.

The blossoming of the Pyrethrum commences in the second year, toward the end of May, and continues to the end of September. Within that period the heads from which the powder is made must be gathered. Experience has taught us the most favorable time for gathering to be the moment when the heads are about to open—that is, when the flowers of the circumference are yet standing erect. In this state the fecundation takes place, and the essential oil contained in the heads has reached its highest state of development. The stalks and leaves, though having the properties in a less degree, may be used also for making powder, but they must be mixed with the flowers in the proportion of a third of their weight. The powder thus obtained will perfectly answer the destruction of insects.

Towards the end of September, at which time the blossoming has ceased, the stalks are cut at about ten centimetres (nearly four inches) from the ground. In proportion as the flowers are cut they are dried in a granary or shed, great care, however, being taken to not expose them to moisture or to the rays of the sun. When completely dried the flowers are to be hermetically closed up into sacks, so as to prevent an untimely pulverization.

In pulverizing them it is commendable to not take a larger quantity than the

wants of the moment may require. The volatilization which, of course, in powder form is more rapidly effected than in flowers, will thus be avoided. It has often been said the drying of the flowers destined for making powders should be effected in sheet-iron plates, as, for instance, the leaves of the tea-plant are dried in China, but we must confess that this operation is wholly injurious to our plant.

The essential oil contained in the Pyrethrum of Caucasus, and which, in regard to its physical properties, can by no means be compared to that of coffee, which is developed only by torrefaction, whilst, on the contrary, under the influence of torrefaction the oil of the Pyrethrum would very soon be volatilized.

PULVERIZATION.

Among the numerous methods tried by us for the purpose of symplifying the pulverization of the dried flowers of Pyrethrum, the one which appears to suit best, with all the conditions required, consists in pounding the flowers in a mortar. It is necessary to cover the mortar with a piece of leather, through which the pestle moves, adjusting it in such a way as to prevent any contact from outside, as generally is done in pulverizing pharmaceutic substances in a laboratory.

The quantity to be pulverized should not exceed half a kilogramme (about one pound two drachms) at a time, thus avoiding too high a degree of heat, which would be injurious to the quality of the powder. The pulverization being deemed sufficient, the substance is sifted through a silk sieve, and then the remainder, with a new addition of flowers. is put in the mortar and pulverized again.

The best receptacles for keeping the powder seem to be flasks, which, if well corked, will keep off moisture most injurious to the properties of Pyrethrum. If the powder is not to be kept for a long time, little boxes will do just as well s bottles.

As will be seen, this method of pulverization is so simple that it can be performed by anybody. The pulverization by steam, which up to this day has been used by us, is, of course, more rapid and perfect than the one performed by hand labor, but unfortunately its expenses are so high that the price for pulverizing 100 kilogrammes is not less than from forty to fifty francs.

PRINCIPAL INSECTS DESTROYED BY MEANS OF THE POWDER OF PYRETHRUM.

The principal insects which by the application of the powder of Pyrethrum are destroyed may be divided into four classes: First, insects injurious to agriculture and horticulture; second, insects injurious to domestic economy; third, insects injurious to certain industrial branches, wool, furs, &c.; and fourth, insects injurious to collections of natural history.

We do not pretend to enumerate here all the insects to which our powder is of a destructive nature, nor do we intend to report all the cases in which the same has been successful; we only want to give a few instances. which will sufficiently show what applications may be made of it.

Our domestic animals, quadrupeds, and birds are subject to vexation by certain insects which cannot withstand the effect of the powder of Pyrethrum. Of all the numerous insects injurious to agriculture and horticulture, we only mention the following which have been destroyed by this powder: The weevil, bark-beetle, leaf-beetle, moths, wheat flies, maggots, coccinella, plant-lice, earwig, spiders, ants, &c. It is evident that not only the perfectly-developed insects are destroyed, but also the larvæ, which, in some cases, do greater injuries than the insects themselves. Large depots where military stores and army supplies are kept, and especially extensive bakeries, may use to great advantage the powder for the destruction of weevil, midges, crickets, roaches, &c., the great

plague of these establishments. Not less apparent is the efficacy of the powder for purposes of domestic economy, in destroying insects which are a constant source of incessant vexation to the inhabitants of cities and the country. Bugs, fleas, and flies will disappear from houses under the influence of this powder.

As to manufactured articles the powder of Pyrethrum is applied effectively to the following:

1. *Furs.*—These require great care for their preservation. Numerous insects are living upon them. Their propagation is rapid. The only remedy against their ravages, up to this day, has been pepper or camphor, but by using the powder of Pyrethrum the insects and their larvæ will be most effectively destroyed.

2. *Feathers.*—The same result will be arrived at by using this powder for the preservation of the costly products of feather dealers. Most of woollen products also have for their enemies quite a number of insects, especially in their undeveloped state as larvæ. The powder of Pyrethrum, if applied in proper time, will give a most gratifying result in the preservation of woollen articles.

Natural history, too, has its share of the advantages offered by this powder in the conservation of collections of mammalia, birds, fish, reptiles, insects, and anatomical preparations.

Herbariums are very frequently devastated by insects gradually piercing the paper as well as the dried plants, reducing the latter almost to powder; the more so, if they have not been poisoned by chloride of mercury dissolved in alcohol, a substance which is both expensive and dangerous. By applying a pinch of the powder between the leaves of his herbarium, the botanist will soon get rid of the enemies of his collection. As a most important advantage of this powder, we may finally mention that it can be absorbed by man without the slightest danger to his health. Some physician of celebrity went even so far as to give it for his conviction that the powder could be usefully applied upon certain wounds which diffuse a bad odor.

METHOD OF APPLICATION OF THE POWDER OF PYRETHRUM.

To bring the powder as directly as possible in contact with the insects, and to apply a sufficient quantity of it, are the two principal points to be regarded in order to make the operation successful.

Indeed, if persons most ardent in denying the efficacy of the Pyrethrum of Caucasus have not met with a positive result, we are not surprised at all, for we know that any innovation, however useful, will have its antagonists more or less disinterested. But we know, too, that those persons could not have operated with the patience and perseverance necessary in almost any enterprise, and could not have observed the rules acquired by us during a long experience. We intend, therefore, to give some instructions which absolutely must be observed to secure success. One might consider the same as self-evident, but the efficacy of the powder of Pyrethrum being rendered incontestable, the destruction of the insects depends entirely on the strictest accuracy in observing the following instructions:

In using the powder it must be applied carefully and in a sufficient quantity, otherwise the result will be unsatisfactory, especially if used against some very resisting species of insects. Sometimes the powder, by being exposed to the air or moisture, may have lost its destructive properties, so as to render the result doubtful or wholly inefficient; at others, the result has been unsatisfactory because the most favorable moment for the operation has been overlooked. A rainy or wet day, for instance, always lessens the destructive efficacy, because the powder containing, as stated above, a very volatile essential oil, renders the conservation of this principle absolutely necessary. Whatever difficulties, in

spite of all precautions for rendering the destruction of insects complete, may arise, the method of applying the powder is simple and easy, and, if carried out with proper care and attention, will secure complete success.

Of all the methods tried by us for applying the powder of Pyrethrum to the plants attacked by insects, the bellows, which is also applicable to the vine, has been deemed best to accomplish the object in view. As there is only a small quantity of powder thrown at once, the loss will be very small, whilst in any other way a good deal of it will fall upon the ground. The powder should be directly applied to the parts operated on, and, with care and precaution, it may be made to penetrate into the most inaccessible parts of a plant. If, for instance, a plant has been attacked by plant-lice which are often hidden or masked by a thick foliage, it will become necessary to turn aside this foliage, so as to have the insects laid open and the powder directly brought into contact with them. The common bellows requiring both hands, it would be difficult to perform the insufflation, and at the same time turn the leaves aside. We have, therefore, adopted a new device, by which the bellows can be served with one hand, leaving the other at liberty to direct the operation.

In a good many cases insects are to be destroyed situated beyond a man's reach. The use of a scale or ladder being sometimes embarrassing, all trouble may be avoided by using a bellows which can be carried to the top of a branch, no matter how long or short it may be. By a mechanism similar to that of a fruit-gatherer, this apparatus can operate and may be directed by a rope passing through the left hand.

In all cases these operations should take place on a warm day, the morning being always preferable to any other time of the day. A slight moisture, arising from the morning dew, will make the powder more easily adhere to the spots where it is applied, and maintain its properties long enough to cause the death of the insects. The insufflation should be renewed several times, according to the nature and number of insects to be destroyed. The first operation generally stupefies them, while at the second or third application they lose their strength, fall to the ground, and die sooner or later. Once on the ground, they may still live for some time, but they are unable to do any injury. It is evident that the powder which during the operation fell to the ground is not lost, as the insects which, by hazard, may have escaped the first time its deadly effect will encounter it whilst on the ground.

In order to prevent the ravages of the weevil on wheat fields the powder is mixed with the grain to be sown, in proportion of two hundred and fifty grammes (about ten ounces) to a hectolitre (two and five-sixths bushels,) which will save a year's crop.

As to insects in dwellings, the insufflation will be performed by means of a bellows of smaller dimensions than those used in agriculture and horticulture. Proper care should be taken in making the powder penetrate where the insects lodge. Furniture ought to be scrupulously searched, and bedsteads and sofas sprinkled in the evening. After thus continuing for several days, the premises will totally get rid of the insects.

As to the preservation of furs, woollens, or feathers, it is necessary, at the approach of spring, to sprinkle those articles abundantly with the powder, the object in contemplation not being the destruction of the insects, but to have a preservative against their reappearance. In connexion with the above articles, we have tried various experiments to become fully convinced of the superiority of this powder to any other substance, as pepper, camphor, &c., hitherto used for the object in view. The insects, of course, would not stay on the spot where pepper, camphor, &c., is applied; but if there is the least space left uncovered the insects will surely reach that, in spite of the poisonous substance in their immediate neighborhood, while powder of Pyrethrum becomes efficacious in proportion as the insect advances towards it.

THE PEAR ORCHARD.

BY JOHN A. WARDER, NORTH BEND, OHIO.

THE *civilized pear* is the result of modern skill, talent, and perseverance applied to one of the most unattractive and even repulsive, forbidding, acerb, astringent fruits that could have been selected from the sylvan groves of Nature. Tasting the wild pear of the hedge-rows no one could ever have imagined the wonderful result of cultivation, transforming so unpromising a subject into one of the most delicious fruits, such as we now find in the civilized and fully-developed, beautifully-colored pear. It may be that among the treasures of that first great garden into which our father Adam was introduced such pears existed as those we now see in our choicest collections, but an acquaintance with the present representatives of the species *Pyrus communis,* which we find occasionally in a wild state, and which we very naturally assume to be the original type, would lead us to suspect rather that, if there were a pear tree in Eden, it might have been selected as the forbidden fruit—forbidden certes it is. The inference that there were no good pears in Paradise is at least flattering to our self-love, since it forces upon us the conclusion that the rich fruits of our times are the result of human ingenuity, the evidence of man's industry, and skill, and genius. Such, indeed, we believe them to be; though aided by favoring accidents man has contributed, within the historical period, and chiefly within quite modern times, to the production of a large proportion of our choicest fruits.

The pear is a native of the eastern continent; it grows wild in Europe, Syria, and China, with its congener, the wild apple, *Pyrus malus;* the tree is beautiful, but the fruit is inedible. In the time of the Romans there were several varieties of improved pears in cultivation, as we learn from Pliny, some of which were introduced from Greece. None of those he names and describes appear to have been handed down to our times, which we need not regret, for, notwithstanding the high praises they received from the ancients, evinced by bearing the names of the emperors, as Tiberianus, because it was a favorite of Tiberius, Pliny concludes his chapter upon the subject with the remark that, like quinces, they leave a bad taste in the mouth, and can only be used when boiled in wine or in water, not otherwise.*

Though not a native of North America, it seems very much at home with us, and some specimens of great size have been described. The Detroit pear trees and the Stuyvesant tree are familiar to many, but even in the west we find some remarkable specimens. The Vincennes pear tree, described some years ago by H. W. Beecher, was planted within half a century. The girth at one foot from the ground was ten feet, and at nine feet from the ground six feet and a half. It has yielded one hundred and eighty-four bushels of pears in a single season, and bears every year. The fruit is of good size and tolerable flavor, ripening early in the fall.

The pear tree is long-lived, vigorous, healthy, hardy, productive, remunerative, and withal it is beautiful as an object in the landscape; whether in mere form, when its naked figure is projected against a wintry sky, displaying its symmetrical conical form of evenly-balanced branches, well furnished with ascending shoots, or gracefully descending spray, beaded with bourgeons, or flower

*Similiter iis argris medentes in escam dant, ac vino et aqua coquuntur, absque pulmentarii vicem implant, quod non alia, prætor Cotonea *et* Struthea. *C. Plinii Naturalis Historiæ, Liber XV, Capit. XV.*

buds, rich in promise of future crops; or when it puts on its snowy dress of abundant bloom in early spring, soon followed by the tender green foliage that soon assumes the richest verdure undimmed by summer heat; or when bending with its autumnal burden of beautiful fruit, often rivalling in rich tints the gorgeous foliage that adorns the tree, it is always a study and deserving the attention of the landscape gardener, though never yet fully appreciated by the masters of that beautiful art.

And yet it may well be asked, if the pear be so fine a fruit as is here represented, and if the tree be so profitable and so beautiful as we are assured, why is it that pears are so scarce in the markets of this country; why do we behold so few of these beautiful trees adorning the landscape? A satisfactory reply to this query is not easily found, but the scarcity of pears and pear trees may be partially attributed to a lamentable ignorance of their merits; to the fact that many of the old varieties are not superior as table fruits; to the proneness of many varieties, in most parts of the country, to a blighting malady, the cause and nature of which are not understood, and which is hence considered incurable; and, perhaps, to the circumstance that only certain soils and situations in our country are really well adapted to their cultivation.

The French are noted for their admiration of this fruit and for their success in its culture. The cultivation of the pear is no new sentiment with the Gallic nation; in their earliest migrations to this continent they introduced the seeds of this their favorite fruit, which they patiently and confidingly intrusted to the earth in their first clearings—at a time, too, when there was more truth than poetry in the old adage that "He who plants pears, plants for his heirs;" at a time when there were few varieties which would yield a crop of fruit in less than twenty years from the seed. Many of the trees thus planted by the French are still standing, noble monuments of the efforts of these early pomologists. We may trace them across the continent, from the Arcadian settlement in Canada; on the Detroit river; at the old posts of the Mississippi valley, some of which have named the modern towns and cities that have grown up around their ruins, and as far south as the Arkansas, on whose shifting shores are still to be seen some of the most beautiful specimens of the pear tree, almost always in situations that induce the belief of their French origin. The Spaniards introduced the pear with the grape into their mission gardens in various parts of Mexico, and they are still fruiting in such situations in California. In more modern times the settlers from Kentucky, crossing the Ohio into the great wilderness now constituting our three noble States, thoughtfully carried with them "the sprouts" of such pear trees as they possessed. The results of these plantings, now become noble trees, serve, like the stalwart men and the names of towns and counties, to indicate the source whence a portion of the early settlers came to occupy these fertile plains—for these trees, like the men who brought them, have marked characters by which they may readily be recognized; like good settlers, as they were, they have made their mark.

If not plentifully cultivated, pear trees have at least been extensively planted in our country, and in some places they have been made to succeed even where, *a priori*, it might have been said they would not grow. Thus, in spite of a northern climate and exposure to the ocean blasts, the cultivation of the pear has been made a success in the neighborhood of Boston, Massachusetts, whence, indeed, the culture of this fine fruit has received its greatest encouragement in the results of the persevering efforts of Perkins, Manning, Wilder, Walker, Cabot, Hovey, and their collaborators. Other points in New England have been equally successful. The old Stuyvesant pear tree in the street in New York city is an evidence that the pear may attain great size and age in that locality, and gave a hint to the elder Prince, and to Parsons, of Flushing, Long Island, to induce their neighbors to plant pears largely, as their noble old trees still testify. The modern cultivation of immense orchards in other parts of that

State, fostered by the energies of the great Rochester propagators, especially Messrs. Ellwanger & Barry, indicates a will and an ability to supply the future wants of the market. In portions of Pennsylvania and New Jersey, guided by the sagacious pomologists Coxe and Bartram, orchardists succeeded admirably with the pear; the Seckel, the Chancellor, the Lodge, the Petrie, the Ott, the Moyamensing, and the Brandywine, all had their birth-place in that region, and have been put upon the page of history by the indefatigable Brinckle. And yet the Philadelphia market is not well supplied from the neighboring orchards but is dependent upon those in other States. Their old favorite butter pear trees that used to be most prolific now scarcely yield a fair specimen of eatable fruit, so completely have they been ruined by the disease called *cracking*. Maryland, Virginia, and other States along the Atlantic seaboard, have had their pear trees, but they have not been so remarkable for their success, which may be simply because proper attention was not paid to the trees after planting them, for Mr. Berckmans, a distinguished pear cultivator from Belgium, the land of pears, having planted some thousands in upper Georgia, declares that he has found that region a paradise for his favorite fruit.

Pears have been grown in this country; pears may again be grown here; pears are grown in some places; they may be grown in many others; let us, then, plant pears. With a view to the encouragement of so laudable an undertaking, and for the sake of diffusing information as to the best means of making a *pear orchard*, this essay has been undertaken by one who has already enjoyed the results of others' labors, and who is now reaping the fruits of his own third plantation of pears; a fact in itself explanatory of the scarcity of pear orchards which may be deduced from this illustration of the mobility of Americans is this, that a single individual, within a quarter of a century, should have planted three pear orchards in different parts of the State of his adoption: we live too fast, we move from place to place, we cannot wait for a pear orchard.

SELECTION OF TREES.

Before setting out a pear orchard it is well to look around among the nurseries and see where we can find the best trees to plant. The excellency of these will depend, not only upon the thrift and hardiness of the stocks upon which they have been worked in the nursery, but also upon the manner in which they have been treated there, and upon the primitive healthiness and vigor of the varieties that have been selected for propagation. Some individuals are faulty in their original constitution, and though for a period of their youthful life they may have been stimulated into an appearance of vigor and health, the original taint will, sooner or later, make its appearance. It is with a pear tree, as with a member of the human family—the taint of an hereditary disease remains sometimes dormant for years, under gentle care, kind treatment, and other favoring circumstances; but the marasmus, or other dreaded evil, only bides its time, awaiting some exciting circumstances to develop the fearful malady. The original seedling may have been defective in some particular necessary to give it the requisite vigor and healthfulness—it may have survived to bear the most delicious and beautiful fruit, it may have been propagated for many tree generations, and always grafted upon vigorous stocks, which have given it an appearance of health, but such a variety will continue to be subject to the ills inherent to its first parent or original. Such varieties should not be propagated; better throw them aside and select only those which possess the vigor requisite to constitute a healthy tree. The orchardist should avoid all such.

It has been suggested by one of the best pear growers of our country, one who has fruited more original seedling varieties than any other pomologist of the age,* that all our improvements in the pear are departures from the natural

* L. E. Berckmans.

condition of the species, and hence we may expect weaknesses and defects of organization in the direct ratio of the change we have effected from the original type—whether this be in relation to the season of ripening or in the improved character of the fruit. It is certainly true that we often find a magnificent specimen of fruit produced by a miserable, unhealthy, decrepid looking tree; this may be thought accidental, and contrary to the axiom of sound fruit from sound trees, but we know that such a decrepid condition of tree is characteristic of certain varieties. Such should be avoided by the planter. Let us have the most vigorous and healthy trees for our orchards, even though the fruit should not be of the very best. There is more profit in a large, thrifty, productive tree bearing bushels of pears of good quality, than in a poor, sickly, straggling specimen that produces only a few very large and handsome fruits of superlatively excellent characters.

Some of the marks of the Wilding pear are the firmness and solidity of the wood, the tendency to produce thorny spines upon the young shoots, and small leaves, but a vigorous and healthy foliage. Such trees seldom evince a tendency to early fruitfulness; they are many years in reaching the termination of their minority in coming to their age of fruitfulness; but in the meantime they grow, and spread, and develop themselves into noble trees; and a theory prevails among orchardists that such trees bid fair to enjoy a prolonged existence. Just such trees, however, are least likely to yield us good fruit; they have about them too little of the civilization characteristic of good fruit. These are not generally selected from the seed bed to furnish new varieties, but, on the contrary, those which depart as widely as possible from the type of the Wilding are chosen. Such as have full turgid wood without spines, and with broad foliage, are generally marked as promising, and reserved for fruiting from the knife of the budder. These frequently bear fruit at a comparatively early age; they are often choice varieties; but we must incur the risk of obtaining fine fruit at the expense of vigor in the tree. The best trees have a happy mean of the two extremes; firmness of wood, freedom from thorns, good healthy foliage, and good fruit, which may be very good.

So much for the characteristics that we should endeavor to have combined in the varieties that we select for planting. Still it is very important that the stocks upon which our trees have been worked should have been of the very best character; of this we shall find it very difficult to judge, and we are forced to depend upon the honesty and truthfulness of the nurseryman with whom we deal. Seedling stocks are undoubtedly to be preferred, though some suckers from the roots of vigorous, healthy stocks have made equally noble trees, which can be seen all over the country. It may be objected that such stocks do not make a good system of roots, and that their superficial roots are always prone to produce numerous suckers that are troublesome in the orchard. This is true; the roots do not descend so directly as those from a seedling pear stock, nor are they always evenly distributed; they are often disposed to one side, and being laterals they come so near the surface as to throw up another generation of suckers; but, on the other hand, these roots, descending less deeply, may for that very reason be better for certain soils upon which the blight is apt to occur, since they may thus escape the great transitions of temperature between the atmosphere above and the cold wet soil below, to which this disease has been attributed by some writers. It can be urged in their favor that we are always able to judge of the hardiness and thriftiness of the parent stocks from which they have sprung; and as they are absolutely parts of these, and possessed of all their characteristics, we thus have a guarantee for these admirable qualities in our stocks; whereas in a lot of seedlings, from whatever source the seeds may have been obtained, we must always expect to find a diversity in these respects—some will be vigorous, thrifty, and hardy, while others are feeble, sickly, and tender; this is true of any lot of seedlings. Whatever impress the

little plants may have received from their parent trees through the seeds from which they sprang, this they will retain through life, and thus influence the healthiness of the scions grafted upon them. Of these qualities we cannot judge after the stock has been worked with a thrifty variety that has made a couple of years' growth; for this is often strong at first, but afterwards fails from the weakness of the stock. We still must depend upon the judgment and honesty of the propagator, and trust that he will have rejected all unpromising stocks in the nursery.

Dwarf pear trees.—The first question that arises in the mind of any one who proposes to plant pears is, whether he shall select the standard or the dwarfs—those that have been worked on pear stocks, or those upon the quince. This is comparatively a new question, for though the French have long propagated the pear in this way, the general introduction of dwarf pear trees is quite modern: but millions of them have been planted in this country within a few years. The object of dwarfing the pear is to throw the trees into early bearing. The stock not being perfectly congenial to the pear checks the circulation of the tree and hastens the production of fruit, in the same manner as a ligature around a limb, or ringing the bark, so that we may now reap our luscious harvest within five years from planting, instead of being obliged to wait patiently for a quarter of a century for some varieties to fruit upon the pear stock. This interruption at the junction of the scion with the uncongenial stock is like something threatening the life of the individual tree, and is followed by fruitfulness, just as we see in animals a sort of instinct of vitality striving to preserve the species from destruction; plants, as well as animals, will gather up their forces to the production of new individuals whenever their own life is threatened by disease.

In such pears as are not uncongenial to the quince, however, the threatened destruction is not imminent, the interruption is but partial, and the dwarf tree is not necessarily short-lived. Dwarf pears have survived a century, and we know not how much longer they may live. Much will depend upon the stock of quince that is used, as well as the scion. Those called the Augers, and the Fontenay, or Paris, should be used, because they have a thrifty, vigorous growth, and because they have proved themselves the best. Other varieties have been found unsuitable. Another point should be mentioned here, the quince is used to give roots to the pear; therefore, in transplanting the trees the junction of the two woods should be set below the surface of the earth. Though the Augers quince is generally preferred on account of its thriftiness, the Fontenay possesses some good qualities that may not have been sufficiently appreciated. With some varieties, at least, it seems to be so well pleased that the stock appears to grow as freely under them as it would have done had it a quince top, instead of a pear, grafted into it.

Having provided a list of the healthy varieties we desire to plant, the selection of which must depend upon our tastes and the object we have in view, whether we intend to cultivate fruit for our own enjoyment and the gratification of our palates, or for the supply of the market, we should proceed to the selection of the trees. Most purchasers insist upon setting out large trees, and such as have been trimmed up as high as possible—the nurserymen will very naturally accede to their wishes, as they can thus dispose of their old stock—and by crowding their rows their trees will run up like hoop-poles; where the young saplings incline to bend over from sheer weakness, they often stake them and tie them up. Such trees are far from being the best. Those that have been worked on strong stocks, whether by budding or grafting, and have made a good stocky, branching growth of one year, or at most of two years, are vastly preferable for planting. Those of but one summer's growth are called maiden trees, and are very much to be preferred for making an orchard, because they suffer less from the transplanting than older trees, but especially because they have not been ruined by the crowding in the nursery, nor by the murderous knife of the

trimmer, "trimming them up instead of down." Select such maiden trees of strong growth, or two year old trees of such varieties as have not made a sufficient top to be safe in transplanting at one year old. Be sure to have them thrifty, and see that the stock, below the graft, is smooth and healthy.

DIGGING.

Next comes the digging which should be done with as much care as is necessary to secure a large share of the roots, none of which should be cut until beyond the second branching, and as many of the small fibrous roots should be preserved as it is possible to save with the tree. Here the difference between the seedling and the sucker will be very apparent. The former will be very apt to have one, two, or three main roots descending pretty directly downwards; these may branch very deeply, and are often quite naked, almost devoid of fibres, unless the stocks have been transplanted once or oftener. The suckers, on the contrary, sometimes have the main root running off horizontally for some distance, branching freely, and well furnished with fibres; but from its position these branches and fibres are very apt to be cut by the spade of the careless tree-digger; on the contrary, a healthy sucker, that has stood two years in the nursery row and well cultivated, will also have emitted a new system of roots, radiating in every direction from the collar, and these will be well furnished with beautiful fibres. Such a one will be in the very best condition for transplanting. The preconceived ideas of propagators will be very much shocked by these statements, nor will they be allowed to pass without criticism. They are given for what they may be worth; they are facts which any one may verify for himself. But I shall not commit myself as preferring this class of stocks exclusively; if used, they should only be taken from trees of undoubted thrift and vigor. It should also be stated that the seedling stocks may be selected, and by a second transplanting, or by root-pruning, the difficulty in regard to their roots may be entirely obviated; moreover, it is impossible to obtain a large supply of suckers adequate to the demand of the nurserymen.

In digging the young trees the greatest care should be exercised to avoid mangling the roots and leaving all the rootlets in the ground. To take up trees in such a manner as to make them look as though they had been eradicated with a mattock is indeed barbarous, and yet we often see beautiful trees ruined in this way. Nothing but the wonderfully persevering vitality of the poor things can save them; they have to produce a callus to cover the terrible wounds inflicted upon them, and then to protrude their spongioles and form new rootlets. The digger should hold his spade so that its plane should always lie in the direction of a radius from the tree as the centre; he should carefully remove the upper layer of soil, watching the superficial roots, so as to avoid cutting them. When a root is discovered, its direction should be noted so as to follow it, and remove it to as great a length as possible. The lower roots should be exposed in the same manner; but as they will not be so easily seen, they may be felt, by bending the tree in different directions so as to ascertain in what quarter the resistance is presented; no force should be exerted in pulling up the tree.

When the maiden tree is dug, the greatest care should be taken to avoid rubbing the buds from the stem, as these are to furnish the lateral branches of the future tree. This needs delicate handling; the stock should be grasped below the bud if possible. When lifted from the earth, the bruised roots should be at once trimmed neatly with a sharp knife and then puddled, or dipped in thin mud so as to protect them from desiccation.

Those who desire to set out larger trees should have them prepared for this by causing them to be transplanted in the nursery, or by root-pruning them early the previous autumn as they stand in the rows, so that they shall be well

furnished with fibrous roots near the stock when they come to be transferred to the orchard.

Mr. Field, in his book on *pear culture*, recommends a home nursery wherein to plant the trees preparatory to forming the orchard. This he describes as follows: "A rich, deep, dry soil should be spaded and thoroughly pulverized to the depth of two feet. In it plant the trees in rows four feet distant, and three feet apart in the rows. Two hundred trees would occupy a space fifty feet square. The roots having been carefully examined, and the laterals pruned to six or eight inches, are spread out horizontally and gently covered with earth. The labor of pinching, pruning, and cultivating will be much less on so small a spot than when the cultivator is obliged to travel over three or four acres, upon which they are ultimately to be planted.

"If at the end of two years it is still desirable to allow them to remain, a sharp spade should be thrust down around them, at a distance of fifteen or eighteen inches, in order to cut the long straggling roots, and thus induce the formation of roots nearer home. This will fit them for transplanting at an advanced stage of growth. In this case, if at the end of two or three years they are removed at the proper season and with care, they will suffer scarcely any check. By pursuing this plan they receive better care, grow faster, and are not liable to damage; and as only good trees will in this case be set in the fruit grounds, none of those unseemly breaks in the rows, caused by death or injury of a tree, need occur."

After the trees are dug and puddled they may be heeled in at a convenient distance from where they are to be planted. A trench is dug with a sloping bank that is raised by throwing the earth on that side. I prefer the trench to be east and west, with the bank to the south side; into this the trees are set, leaning them to the bank; fine earth is then carefully filled in among the roots, so as to leave no openings for mice or air. The reason for this preference, when the trees have to remain all winter in the trenches, is, that the tops shade themselves and the roots, and the soil about them is not exposed to the influence of the sun, thawing them frequently, as would be the case if they were leaned to the north.

SITE AND SOIL

The site for a pear orchard is a matter of considerable importance, though it is of less consequence for the pear than for some other fruits. Care should be taken to avoid a low, wet, or frosty location; an elevated plateau is generally preferred, but sharp, gravelly, or rocky ridges should be avoided, as they are unpromising situations for this fruit.

The best soil for standard pears is generally supposed to be a rich clay; that for quinces or dwarf pears, a deep friable loam; a good loamy clay will do very well for either. Robert Douglass, of Waukegan, Illinois, near Lake Michigan, is so successful a pear grower that his advice from that northern prairie region is most valuable. He says that "the pear will flourish on any prairie soil in which there is a mixture of clay and loam, if so elevated as to prevent the roots from coming in contact with standing water. As a general rule, the more elevated the better, as the roots of the pear go so much deeper than is usually supposed; and it is very doubtful whether land in which water can be found for months together within three or four feet of the surface can ever be made suitable for a standard pear orchard, even if thoroughly under-drained to that depth; though dwarf pear trees would do well on such land, as the quince roots grow near the surface of the ground."

"There are comparatively few prairie farms on which there is not an elevation several feet above the ordinary level; on such a site, even if too flat to let the water pass off freely, the land can be ploughed in ridges, upon the cen-

tres of which the trees may be planted; if under-drained, so much the better, placing a drain equidistant from the rows of trees."

The soil upon which the fine old pear trees of Detroit grew has been described as a sandy loam, resting upon a thick stratum of clay. Many noble pear trees have been found elsewhere upon a similar basis.

PREPARATION OF THE SOIL.

The pear likes a clayey soil, but it does not thrive where there is too much moisture. All of our clay lands will be benefited by thorough draining, nor will this process be of less value to the pear orchard than to other crops of smaller value. It is only a question of expense, and that is so great as to induce many persons to avoid it when they have a choice of soils, so that they can select a position on dryer loamy land, instead of taking that which would be more suitable for the pear orchard, could they make up their minds to incur the necessary outlay for thorough drainage.

For the standard pear the soil may be very well prepared by the plough, thoroughly breaking up the surface as deeply as possible. The best implement for this purpose is the double Michigan, or trench plough, by which the soil may be reversed and thoroughly pulverized to a depth of fifteen inches, which is more than some land will bear. The sub-soil plough (Mapes's lifting sub-soil) should follow in the track of the trench plough, and by this means the ground may be stirred for eight or ten inches at the botton of the furrow. This will generally be the sub-soil, and not well adapted for bringing to the surface, but it is very desirable to have it broken up. The best team for these ploughs, in a stiff soil, is three yoke of oxen, which may easily be transferred from one tool to the other, at the end of each bout. In ploughing flat lands, like much of the prairies, it is well to back-furrow on the lines where the pear trees are to stand, so that they may be planted on a ridge, which will give a considerable surface drainage, and leave an open dead-furrow half-way between the rows of trees for drainage, and where, at any future period, drain tiles may be laid. The natural inclination of the surface should be observed before ploughing, so that these furrows may have sufficient fall to avoid the retention of water.

For dwarf pear orchards, when they are of large size, like some on the prairies of Illinois, containing thousands of trees, this method of preparation, if very thoroughly executed, will be found to answer a very good purpose, and upon such a scale it is as much as we may ever expect to see done, until some great steam digging machine be successfully introduced that shall produce a more thorough pulverization of the soil to the desired depth. For smaller plantations of the dwarf pear, however, it is conceded that a thorough trenching of the soil by hand to a greater depth is, at least, very desirable, if not essential. Drainage is equally serviceable.

PLANTING.

This very important step in the progress of the formation of the pear orchard will require the exercise of some skill and care and a great deal of patient labor. The common plan of digging holes, however, may be entirely obviated by the use of the plough. The first question is as to the order of the planting, whether it be desired to set the trees in rows, in squares, or in the quincunx order; the next will be the distance between the trees. If in simple rows, a clean furrow may be opened in the line to be occupied by the trees. These, in the ridged land, will be upon the top of the ridges, and the furrows will furnish nearly all the excavation necessary for planting. If the trees are to be planted in squares, light furrows may be drawn at right angles to the first, at the appropriate distances. Their intersections will indicate the tree stations, when the rectangular plan is adopted.

The distances between the trees will depend upon their habit of growth, of which there is considerable diversity. The dwarfs will, of course, stand closer than the standards, and, with the latter especially, it is good economy to prepare the soil perfectly, and to crowd the trees as closely as they will bear, and then to cultivate the soil by hand, or to mulch the surface. Some varieties of dwarfs should be placed six feet apart; others eight feet; while others would not interfere with one another at five feet apart. If the dwarfs are to be cultivated by horse power, as must be done in very large orchards, they will need more space; the rows may be fourteen feet apart, and the trees six or eight feet apart in the rows; ten feet each way is a very common distance. Standard pear trees should be planted twenty feet apart, and some varieties will require much more space for their proper development.

The quincunx order of planting is not so simple an affair as is supposed, nor is it generally understood. A description shall be attempted, as it offers the plan by which the greatest number of trees may be set upon a given area, so that each shall have the greatest possible space. A false quincunx consists of planting a tree in the centre of every square in the orchard.

Mr. Field gives the following directions: "The true quincunx arrangement is formed by placing the trees at equal distances from each other in every direction; and when the distance proposed is ten feet, it will be necessary that the rows should be laid out at eight feet eight inches apart, and the trees planted ten feet apart in the rows. By this arrangement each tree occupies the centre of a hexagon of equal sides, and is consequently equidistant from all the adjacent trees—exactly ten feet separating each tree in the plat from its neighbors. By this method five hundred and sixty-three trees may be planted on an acre, as we gain space for three additional rows.

"For a pear garden I have found ten feet to be an ample distance: and for planting an acre, would recommend that the eleven trees at each end of the plat and one entire row of twenty-three trees should be omitted in planting, and that the space occupied by the row should be divided on each side of the plat, so as to leave a clear unoccupied space of five feet all around.* Five hundred trees will thus find ample room upon an acre, and may yield their fruit to one generation before they will give evidence of being crowded."

This diagram represents the true quincunx order of planting, the rows being eight feet eight inches apart, and the furrows ploughed; the light cross furrows being made every five feet, the stakes may be set so as to range in four directions; in one of which the spaces between them will be eight feet eight inches wide, in two directions they will be ten feet, and in one they will be but five feet. Thus may be planted all dwarfs or all standards, or the two may be combined, as represented in the diagram; the letter S indicating the standards, surrounded by dwarfs, every alternate row in any direction will have a standard alternating with a dwarf; the other row will be all dwarfs, or one-fourth of the plantation. Each tree will be ten feet from each of its neighbors, which will form a hexagon about it.

When the ground has been laid off, the stations may be marked by a stake three or four feet long, which is to be driven firmly into the ground. These can be made to range correctly, and will guide the planter in setting the trees. Everything being prepared, and the trees dug, puddled, trimmed, and heeled in conveniently, each sort by itself, the parcels are taken to their rows, and the trees are distributed to the stations by a boy, just in advance of the planter. Each tree is to be set by a stake, (the north side is preferred,) the soil is removed where necessary to accommodate the roots, and to give a fresh surface

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*This calculation is based upon the arrangement of a plat of 100 feet by 218 feet, upon which he plants eleven rows of twenty-three trees each.

if the furrow be stale; the fibres are carefully spread out, and some fine mold is sifted among and upon them from the hand or spade; a slight shake of the tree will assist the settling of the soil among them. Gentle pressure with the

foot, particularly at the outer ends of the roots and towards the stem, but not near it, will render the tree firm in its place, and then the cavity should be filled

up with fine earth loosely thrown in. No manure should be used near the tree; the common soil properly prepared is best. When completed, the tree should be a little deeper than it stood in the nursery, if it be a standard on pear stock; but if it be a dwarf it should be set still deeper, so as to have the junction of the pear and quince a couple of inches below the surface of the soil.

It will be observed that by the method here proposed there is no digging of holes; none are needed beyond fitting the furrow to the roots of the tree, which is but the work of a moment in moving the fresh mould, or, in the planting of dwarfs a slight deepening of the furrow, to enable us to set these trees deeper than they grew in the nursery. But even this may be obviated, and with advantage, by cutting off the lower end of the quince stock, leaving the upper roots. We thus avoid the risk of setting the quince roots too deep, for they have been found to suffer from this in some soils.

The stakes are intended, first, to mark the stations where the trees are to stand; next, and always while they remain, to protect the tree from the horse and from the single-tree while cultivating the soil among them, also to shade the young stem from the sun, but never to secure the tree in its place by tying; if the young tree cannot stand without a stake it had better fall down, be cut off, and begin again; the judicious pruner and cultivator should be able soon to make it stocky enough to stand alone. So soon as the indications for the stakes have been answered let them be removed; this will generally be at the end of the first year; they should be pulled up when the ground is soft. Some care may be needed while they remain that these stakes do not chafe the bark of the tree.

In fall planting a mound of earth should be thrown up around the tree to protect it from frost, to turn off the water, and to steady the tree against the wind; this is to be removed in the spring. However, the maiden trees recommended above do not present much surface to be blown upon, particularly after they have been trimmed as directed. If the mound of earth be not made, a liberal mulching of straw or long manure will answer a good purpose as a protection from frost, but care should be taken that none of it comes very near the tree to afford shelter for mice, that might kill it by girdling the bark. Rabbits may be driven from young trees, which they are very apt to gnaw, by smearing a little blood upon the stem with a swab, or by encircling them with a half sheet of coarse wrapping paper, set as a cone, with its base upon the ground, and tied loosely about the tree with common white grocers' thread at the upper end. The paper will last through the winter, and the cotton string will rot away before the tree begins to grow in the summer. In spring planting the same precautions are to be adopted, except that the mound is never made, but instead of it a basin may be formed about the tree to collect rain water; artificial watering is seldom practiced, indeed it would, in many cases, be highly injurious if done before the leaves grow.

The best season for planting pear trees will depend much upon the soil and exposure, as well as upon the character of the winter climate. Most planting is done in the spring, which is generally considered a very favorable season, as all vegetation is then about to burst into life; but it is always a period of hurry and bustle, and on that account many persons prefer the autumn. Trees may be transplanted at any time when vegetation is dormant, that is, from the fall of the leaf until the buds swell in the spring. This period may be anticipated by stripping the leaves in the autumn after the wood has ripened. A very important element in the success and comfort of planting is the condition of the earth; this should be dry enough to crumble readily when stirred with the spade. Clay lands will not be suitable for planting when wet, as they are apt to be in the spring; such had better be planted in the autumn. Damp or showery weather is not to be selected of choice, and on clay lands such weather should be avoided; frosty weather is equally objectionable, and windy weather is very obnoxious to the roots, exposed as they must be in transplanting.

CULTURE.

The amount of cultivation bestowed upon a pear orchard will depend very much upon the energy and earnestness of the proprietor; so, also, the quality and value of the crops returned to him will be in the direct ratio of the amount of care and culture he has given to his trees. This will apply particularly to the orchard of dwarf pears. The trees must be well cared for, thoroughly cultivated, and, when the soil is not already fully supplied with all the needful elements of their plant-food, they must also be well manured, or they will result in disappointment, mortification and loss. The ground should be devoted to the trees alone, though, for a few years, low, hoed crops may be allowed among them. No grass or grain crops should ever be grown with the pears, nor are weeds any better suited to their tastes. Thorough culture of the surface-soil should be given among the trees; the quince roots being superficial, care should be exercised to avoid injuring them; hence the propriety of thorough preparation of the ground in the first instance, close planting, and hand labor for dwarf pears.

Standards, if well cultivated for a few years until they have attained some size, during which period corn or other summer crops may be grown among them, can afterward bear a degree of neglect, or they may be seeded down with clover or grass, which will check their too vigorous growth and promote their fruitfulness. This, however, should not be attempted until the trees have attained a good growth. They had better be kept cultivated five or six weeks before being seeded down with clover, which is preferred to any of the true grasses. We should not count upon making a meadow of the pear orchard, but let the crop rot upon the ground, and, whenever the trees appear to need culture, plough under the clover, and cultivate the ground for a season or two.

The rows in which the trees stand will need careful hand labor with the hoe, or, still better, with the pronged hoe or the digging fork, even when horse labor is practiced between the trees. There will be a space that cannot be reached by the horse cultivator, and this must be worked by hand. In large orchards, as before mentioned, whether of dwarfs or standards, particularly in the prairies, where they are exposed to severe winds, horse power is necessary to economize labor. In such situations corn is the best crop to grow among the trees, and this should be left standing on the ground during the winter as a protection for the trees, and the stalks ploughed in the following spring will help to manure the soil. After the trees have acquired such a size as to preclude the growing of corn, which should never be planted within four feet of the trees, the ground may be sown with buckwheat at midsummer, not for a crop of the grain, but for the sake of mulching the surface and keeping the soil loose.

TRIMMING.

Trimming, which includes pruning and pinching in, should be well attended to. The objects are two-fold: first, to form the tree into the shape desired; and, secondly, to produce fruitfulness. Both processes should be conducted upon philosophic principles, very easy to be understood, but not by any means easy to explain in language so as to meet the comprehension of another. To begin with the first cut, I should prefer to plant maiden trees; that is, one year old from the bud, whether dwarf or standard, and in either case to have them budded low, near the ground. This is particularly essential in the dwarf, as the tree should be planted so deeply as to cover all the quince stock beneath the surface of the soil. If the tree has been well treated in the nursery, it may be already furnished with side branches. At the time of digging, or before planting, the main shoot should be cut back severely, say to one foot in height from the bud, if a strong plant; more severely if the tree be feeble. If there be

side branches, these should be spurred in to two or three inches. The object of this severe spring pruning is to restore the balance with the injured roots, and also to insure a vigorous growth at the base of the future tree, for here is the foundation. Hence is to proceed the skeleton of the tree that is yet to be grown. During the first summer the shoots should be allowed to grow pretty much as they please, only curtailing the most rampant and aspiring branches, where they are produced at the expense of their fellows; and wherever two branches interfere one of them may be removed, or they may be separated by a prop. As a general rule we leave too many branches. We cannot have too many twigs at this stage of growth, when every leaf is of value, but the growth must be so controlled as to prevent the formation of too many large limbs. We should secure the few which are needed to form the tree and give it symmetry. The next season, in the spring, the trees will again need a severe pruning. A leader should be selected and well shortened in, say to six, eight, or ten inches, according to the strength of the plant; all other branches are to be well shortened and thinned out. The trimmed tree should resemble a distaff, with its outer or lower laterals the longest, for we are attempting to produce a conical tree, or, as it has been called, a pyramid. This is the natural form of many pear trees, and it is the most desirable form, though sometimes rather difficult to produce in trees of a fastigiate and upright habit. Such more naturally assume the form which the French call the quenouille. The third spring a similar system of pruning should be pursued to insure the development of the desired form and to produce thrifty growth. Up to this time the trimming has all been done with a view of producing the proper form and to insure a vigorous growth of wood. These points having been secured, the form and thrifty growth having been established, we may now begin to turn our attention to

SUMMER PRUNING AND ITS OBJECTS.

A new system of tactics is now adopted, founded upon different physiological principles. Supposing that the natural vigor and the encouraged growth of the specimen have by this time produced a strong, wide, stocky, conical tree, strong enough and large enough to support a goodly crop of fruit, we may proceed to throw it into fruitfulness; if we have not attained this condition, a severe spring pruning must still be continued, or we may find it necessary to cut back to the main stock near the base, to secure the requisite vigor and thus commence the work anew; for it may be assumed that, though a small dwarf may produce fruit at once, it can never produce a paying nor a satisfactory crop, unless it have become a well-developed cone of sturdy branches in a good, thrifty condition of healthfulness. Trim every conical tree so that each limb shall be shorter than those below it. The axiom which should be indelibly impressed upon all pruners of dwarf trees, especially, is this: *Prune in winter for wood, in summer for fruit.*

The summer pruning consists in the shortening-in of the branches, which may be done with a knife or with the thumb nail, according to the watchfulness and judgment with which the trees are tended. The object is to check the wood growth and to direct the development of the buds and the enlargement and fruitfulness of the spurs which are to bear the blossoms and fruit. It is difficult to give definite rules and dates for the performance of this work; the enunciation of the principles that are to be followed is all that can be attempted. Every man's good sense must be his guide in each particular case. In the growing season, whether May, June, or July, when a strong shoot makes its appearance, straggling out of bounds or towering aspiringly upward, the end may be nipped; the precise point at which this is to be performed will depend upon its strength and the lateness of the season, and the prospect we have of growing

weather; the earlier the less severe, the later the more trenchant should be the shortening of such a shoot.

If severely cut back in the early part of the season, the vigor of the tree will attempt immediately to repair the damage inflicted upon its wood system; a new wood-shoot, or perhaps two or three of them, will start out from the remaining portion of the one that was cut back; if so, let them again be pinched after they begin to harden, our object being to develop the parts below to direct the flow of sap into them, to diffuse the sap over the tree. If the season have become more advanced when such a shoot is observed, or, if the pinching have been neglected until after the summer solstice, when we do not expect such a vigorous growth, we may use the knife instead of the thumb-nail, and cut back more severely; but still we must endeavor to avoid the rampant breaking of watery shoots, which are not fruitful and which must again be shortened. *Per contra*, if we do not sufficiently curtail these shoots, and do it early enough in the season, we shall have to throw away a large amount of the wasted energy of the tree and the lower buds will not have been developed, and the desired fruitfulness will fail to be produced.

With some varieties of pears early fruitfulness is a fault, so that, if allowed to have their own course, our trees would never become well-grown—the wood-shoots are few, while the spurs swell very rapidly and are very abundant. If allowed to blossom and bear, the proper form of the tree will never be developed. Such trees require great severity of pruning, and great determination in thinning the buds and fruit, to encourage the wood growth. Others, on the contrary, have such an excessive tendency to wood as to have acquired the epithet of slow bearers. Such naturally form the most beautiful trees with the least trimming, and they need the greatest amount of summer pruning to render them fruitful within a limited period; but, when they do bear, they produce the most satisfactory crops. This part of the subject may here be dismissed; it is hoped that every one will have a clear view of the principles that have been brought forward; then, with common sense, in reasonable amount, the orchardist may whet his knife and go to work at his pear orchard. The pruner should be able to see the skeleton of the future tree which is growing; the whole outline should rise before his mental vision, and the detail of spurs, leaves, and fruit should cluster about it in his mind's eye while yet he is dealing with the tree in its distaff form.

These directions for pruning are especially adapted for an orchard of dwarf pears, but the principles are the same in pruning standards, except that where they are root-pruned, for the sake of dwarfing and to promote early fruiting, very little attention is usually bestowed upon their summer pruning; we are generally content to wait for their fruits until the tree naturally assumes its fruitful condition or maturity after the lapse of years. The conical form, with low branches, is preferable with standard as with dwarfs, and accelerates their fruiting.

The *quenouille* form is a fancy mode of training particularly appropriate for certain varieties of very close-growing, upright pear trees; it may be practiced, however, upon any variety to which the ingenious amateur may desire to apply his talent. Some spreading varieties, however, will give him no little trouble. The quenouille consists of a very tall, compressed cone, represented in nature by the Lombardy poplar, but the pear will not naturally assume this form; it must be severely trimmed into it. A main leader is preserved, and this is repeatedly cut back, as are all the laterals that spring from it, the leader being kept always in advance of its fellows. The chief merit of this form is that it enables us to crowd a great many trees upon a small space. *Arched* training consists in tying down the limbs to give them a weeping habit and to promote fruitfulness; this has sometimes been called the quenouille, but erroneously. None of the various methods and forms of pruning the pear is so good as that which is most natural to it—the *conical*, or, as it is often erroneously called, the

pyramidal form. When properly grown of this shape, and kept sufficiently thinned out, every limb, every branch, every twig, and its every leaf and fruit, will be favorably exposed to the air and light.

ROOT PRUNING.

The object of this treatment is to check the long growth of roots, and to aid in making fibres. It is practiced chiefly with nursery trees to keep them in a condition suitable for transplanting, and also upon standard trees that are planted among dwarfs, or those that we wish to keep within bounds and to bring early into productiveness. In the nursery it is sufficient to cut down beside the tree with a sharp spade that will sever the descending roots. The tree in the orchard must have a trench dug around it within a few feet from the stalk, severing off the roots, which are then to be trimmed with a sharp knife, cutting the slope on the under side; good soil or compost is then filled in, and the result will be the production of a large amount of fibrous roots, which are conducive to fruitfulness.

Mr. Rivers applies this treatment to dwarf pears also, which he wishes to throw into bearing and make productive. As stated elsewhere, we find the quince-rooted pear only too prone to injury from overbearing; and sometimes we have to resort to very severe winter pruning, even to decapitation of the tree in connexion with stimulating cultivation, to restore the tree to a proper balance of wood growth. Mr. Rivers's plan is described by himself as follows: "A trench should be dug around the tree about eighteen inches from the stem every autumn, just after the fruit is gathered, if the soil is sufficiently moist; if not, it will be better to wait till the usual autumnal rains have fallen and the roots carefully examined; those inclined to perpendicular growth cut with the spade, which must be introduced quite under the tree on all sides so that no root can possibly escape amputation, and all the horizontal roots, except those that are small and fibrous, should be shortened with the knife to within a circle eighteen inches from the stem, (if they have not spread out to this extent they need not be pruned, but merely brought near the surface and spread out,) and all brought as near the surface as possible, filling in the trench with compost for the roots to rest on. The trench may be filled with compost and the mould from an old hot-bed, equal parts; the surface should then be covered with half-rotten dung, and the roots left till the following autumn. It may be found that after a few years of root pruning the mass of fibres will have become too matted, and that some of the roots are bare of fibres toward the stem. This treatment will cause them to give out fibres, so that the entire circle of three or four feet round the tree is full of fibrous roots near the surface, waiting with open mouths for the nourishment annually given them by surface dressings and liquid manures. Handsome trees may be produced by shortening the shoots in the summer, and if the trees are inclined to grow too vigorously occasional root pruning with the spade will be sufficient; this may be done biennially or triennially."

Field gives the following rules for pruning:

1. Cut near a wood bud when pruning to perfect the shape. [To which he should have made this very important addition: a bud that looks in the direction we wish the new growth to take.]

2. Prune severely in the spring those branches that are desired to grow vigorously. [I should say early spring.]

3. Pinch in summer, and partially deprive of leaves those branches that grow too vigorously and absorb too much sap.

4. Thin, weakly [slender?] shoots should either be pruned close or left entire, with a terminal bud; the more vigorous ones being, at the same time, stopped by pinching.

5. Let the severest pruning be performed on the tree when young, [or, when we desire to make it grow vigorously.]

6. To develop fruit buds, break, pinch, or twist the shoots above the buds intended to be developed.

7. Prune when the sap is active, that the wound may heal quickly, [at midsummer.]

8. When trees are tardy in coming into bearing, prune severely in the spring, pinch constantly in summer, and root prune in early autumn. [To this I object, and should suggest summer as the season for severe pruning.]

9. When a tree has been removed prune off the branches in proportion to the loss of roots.

To these may be added the advice of the old Scotchman to his son, as to the time for pruning: "Have yer knife aye sharp, Jock, and keep it ever in yer hand."

DISBUDDING—THINNING THE FRUIT.

Some varieties, especially when worked upon the quince, have such a tendency to fruit as to injure the tree and the crop, if left to themselves. Some of these blossom most abundantly every year, but do not appear to have sufficient vigor to retain their fruit; the imperfect pips are cast to the ground in immense numbers soon after the fall of the blossoms. This has been attributed to the influence of frost, but it may be well to inquire whether there be not some other cause; whether the strength of the tree may not have been exhausted in the production of an excessive bloom. This explanation was suggested to me by a conversation with Mr. Field at the American Pomological Society's meeting at Philadelphia. He said he had observed that a row of trees standing next to the cart-way, and often rubbed by the wheel, and apparently much injured by this rough contact, always bore a larger crop than other trees of the same sort not exposed to this treatment. Acting upon the suggestion thus afforded, he disbudded the other trees very severely, and the result was highly satisfactory, in a full crop of pears.

Thinning the fruit should always be attended to; a little savage determination is requisite, nay, a great deal of it, or the good effects of the process will not be realized. He who is too covetous to thin his pears will reap the reward of his own meanness by having only the meanest crop, while he who removes half, or even three-fourths, of the fruit set on his trees, will have noble and beautiful specimens, the aggregate weight of which will exceed the whole mass of the little, mean fruit from the tree that was left unthinned.

GATHERING AND RIPENING.

These are two very important points after we have grown our trees and obtained our crop of pears. With very few exceptions this fruit should be picked when ripe, but before it is perfectly matured. The house-ripened pear is generally infinitely superior to that which is allowed to hang too long on the tree. The fruit should be ripe when plucked, else it will wilt and be insipid. A good rule is derived from the easy separation from the stem. When the fruit begins to fall freely it should be gathered. When harvested the pears should be placed in a dark, moderately cool and dry apartment, if we wish to preserve it. To ripen it up to its highest perfection, the temperature should be higher, or that of summer. Without going into details, this indicates the principles which are to guide us in the management of the crop. There will be modifications of treatment for each variety; these can only be learned, however, by practice and experience. Some fruit must always be gathered before they are quite ripe, else they will rot at the core; others part so readily from the tree that they are lia-

ble to be blown off when half grown, when they are unfit for gathering, and will wither and wilt; while, again, there are some that may be thinned when half grown, and the pears can be ripened perfectly well.

The Massachusetts Horticultural Society, in reporting upon a plan for ripening winter pears, gives the following account: Mr. John Gordon, of Brighton, cultivates between three and four acres almost entirely covered with pear trees, thickly planted, two-thirds of which are on quince stocks. He raises but few varieties, and these are such as he finds sell most readily in the market, and make the most profitable return. All his fruit is carefully picked by hand, and for five or six days before taking it to market it is packed in boxes twenty inches square, and six or eight deep, with a woollen lining at the bottom, on which is placed one layer of pears; that is covered with woollen cloth, and another layer of pears, which is covered more thickly with woollen cloth and placed away for what he calls the sweating process, which gives the fruit a rich coloring and ripens it for market. Mr. Gordon states that cotton does not produce the same effect, nor ripen the fruit so fast. And that the result of this care is best seen in the prices obtained; for while his Bartletts were yielding him ten dollars a bushel in Boston, other wagons beside him contained pears of that variety which were sold for only three dollars a bushel, on account of their unripened condition.

The ripening of winter pears is in nowise a more difficult problem, though, owing to the conditions of the climate, a more difficult practice; indeed the treatment is the same, except that as the pear tree, in its variety, departs further from its natural condition, one of the elements of which is ripening its fruit in autumn, so will it, in the same ratio, be likely to differ in many respects from the normal type.

The practice is often found difficult, and success depends upon our ability to keep our fruits cool and dry—cool enough to prevent rotting, and so dry only as to preserve them from wilting. These two extremes are the bane of winter pears; especially will the few choice specimens suffer, which an amateur looks upon with so much pride as the first fruits of his trees of promise—such as he carefully places upon his mantel, where they dry, and wilt, and become worthless. Such specimens were much better out of sight, closed from the atmosphere, and, in bulk, if no companions of their own species can be provided for them, let them be packed with apples, or even with potatoes, that they may be protected, at an equable temperature, in a close atmosphere. When the period of ripening arrives, they should be brought into a high temperature, and in a few days the desired changes will have taken place in the laboratory and studio of nature—they will have acquired their appropriate rich saccharine juices, and will warm up with the ruddy tints of their perfect ripeness. The greatest difficulty in all this is to know the period of ripening of each variety, and for each season; this will vary somewhat in different years; it must be ascertained by constant watchfulness, and can be detected by the practiced eye. Fruit-rooms may be very desirable, but very good specimens of house-ripened fruit may be obtained without them.

In a commercial way the pears are best packed at once in barrels, into which they are carefully placed by hand; headed up as soon as they have gone through the sweating process, by which they are supposed to have parted with a portion of their internal moisture; then kept cool without freezing, and as dry as possible, for in the barrels they will not wither; and if designed for market, let them be transported to their destination as quickly as possible, else their ripening, and, possibly, some rotting, will render safe transportation without repacking impossible. Dry leaves, in alternate layers, make a very good packing material for fruit, and soft paper may be used to advantage, where the value of the fruit will justify its use and the labor of wrapping each specimen.

Gentlemen who have been in Paris always come home eloquent in the praise

of the beautiful pears and of their delicious qualities, and from them we hear this rebuke, "No one ripens winter pears in America." We have grown some very good fruits of this description, but we have been ignorant of the best modes of preserving them until their proper season of ripening, and we are only beginning to understand the conditions of temperature requisite to develop their saccharine and aromatic qualities in perfection.

USES.—SELECTION OF VARIETIES.

The varieties of pears are exceedingly numerous. However, not satisfied with the limited number of sorts that have been handed down to us from the ancients, nor with the chance seedlings of excellence that were from time to time discovered, man has exercised his ingenuity in the production of new varieties by hybridizing favorite sorts, so as to obtain new kinds that should combine the good qualities of the best. We thus have many hundreds of varieties now upon our lists, and it is puzzling to a novice to make a selection for his wants. Among them all we find some which are better suited to one purpose than to another. We generally consider the pear particularly as a dessert fruit, but there are some which are eminently fitted for cooking, and others that are especially adapted to the making of perry, or pear cider, a delicious beverage, often used in the fabrication of champagne, for which it is better adapted than cider, though, of course, not equal to the juice of the grape, which alone should be reckoned as a suitable material for wine-making.

Some persons think that any fruit which is good to eat should be good to cook. This is not so. Many fine fruits that have a delicious flavor and exquisite aroma are flat and insipid when cooked. This is particularly the case with the pear, as any one may have noticed who has seen the Bartlett, the Virgalieu, or the Seckel, preserved with sugar; they are fair and beautiful to behold, but flat and insipid, mere vehicles of sugar and of the spices which the mischievous genius of cookery has added, forsooth, to improve the flavor of such delicious fruits. There are some pears, however, which are especially adapted to cooking, and they generally have a degree of asperity or astringency that renders them unfit for the dessert, though some of these, when properly matured, become very palatable in their native state. This does not militate against the proposition that table pears are unfit for cooking, since in their well-ripened condition their asperity will have disappeared, and the fully developed characters and aroma of the fruit will be dissipated by heat. They are then unfit for cooking.

Our selection of varieties for the pear orchard will therefore depend upon the objects we wish to attain, the demand we desire to satisfy. The selection may be made to supply the wants of the amateur for his table, the requisitions of the ladies for their pantry, the call of the butler for perry to replenish the cellar, or to satisfy the demand of the public in the market, for they may be classed, according to their qualities, as *table* or *dessert*, *cooking*, *perry*, and *market* pears.

Some persons may object to the last subdivision. That it is a well-founded distinction all pear-growers must admit; there are many varieties of hardy trees that produce abundant crops of fruit that may be only of medium quality, and yet, being of fair or large size, of good form and striking appearance, and perhaps, also, well known to the public, they are always sure to meet with a ready sale at remunerative prices. These are what are called market pears, and for orchard planting they are the most profitable, though the amateur might think them unworthy of a place in his collection.

Mr. Downing once wrote a capital article upon the "malady of many varieties;" but in spite of his admirable description, and the excellent cautions which he communicated to the public against this great error of tree planters, we find them still disposed to try every variety of pear that comes within their reach. Some persons should test all the varieties of fruits in the different parts of our

extended country, and give the results of their experience to the public for the guidance of other planters. This has already been done to a very great extent, and the reports of the pomological societies contain much valuable information; but there are many new varieties introduced every year which have yet to be tested. He who plants a pear orchard, however, will act wisely in selecting a few well-known varieties which have stood the test, and have proved themselves desirable on account of their hardiness, healthiness, productiveness, and because they are acknowledged as good market fruits.

THE HEALTHINESS OF THE VARIETY.

Too much importance cannot well be attached to procuring healthy varieties, and hence the recommendations of fruit committees may be taken with a few grains of allowance. They may have no knowledge of the tree and its habit of bearing, its hardiness and thrift, but report only upon the delicious, well-ripened specimen before them. This they are often obliged to do with new varieties, with the true characters of which they have not had an opportunity of becoming acquainted. Plant none but hardy varieties, and endeavor to procure healthy, thrifty specimens, if you wish to have a successful orchard.

DISEASES.

Though the pear has been called a healthy plant, though it has been considered hardy and long-lived, those who have had most to do with this tree must confess that it is not exempt from disease—from disease, too, which has baffled all their efforts to prevent. The malady called the *blight*, or the *fire-blight*, or the *frozen sap-blight*, has produced sad havoc in the pear orchards in some parts of the country; and the ignorance of the causes of the disease, combined with the futility of all the empirical treatment that has been applied to them, has given the disease a mysterious character that may wholly disappear when the true nature of the blight shall be discovered, and when we may hope to find some dependable mode of treatment, and still better, of prevention. At present we are lamentably ignorant of the causes and of the nature of the disease, and all our treatment is necessarily empirical. A vast amount of theoretical suggestions have burdened the press, during the last quarter of a century, in vain attempts to explain this disease, but all of no avail. The only proximate results have been that certain varieties which make a moderate and firm wood growth, and such trees as grow on thoroughly drained soils, are less subject to the malady. When a tree is attacked by the blight, the only thing that can be done is to cut off the part affected; this has been urged as a means of preventing the spread of the disease, but it may rather be viewed as a matter of looks; the blackened foliage, giving the tree an unsightly appearance, should be removed, and the dead portions being out of the way a new growth can come to replace it. Many neglected trees may be seen where the blighted portions have been allowed to remain for years until the tree had quite recovered its fair proportions by new growths, without any further attack of the disease. We are forced to confess, with humility, that we know little or nothing about the blight, except that it periodically appears and sweeps away our hopes of fruit by destroying a great many trees.

The leaf-blight is most severely felt upon seedling stocks in the nursery. The leaves spot and turn black and fall off, causing a suspension of growth and consequent injury to the stocks. It appears most frequently in the wilding stocks, for when they have budded with cultivated varieties the buds grow and do not suffer from the disease with the stocks beside them. It is believed that if the stocks can be kept growing without check, they will escape this disease.

Bark lice attack the pear as well as the apple trees, in situations where this pest exists, but the pear is also subject to another kind of bark louse, which is

rather an aphis than a coccus. It generally appears upon diseased or unhealthy young trees, and gives the bark a whitish appearance. Whale oil soap, solutions of potash or of soda, and coal oil have all been used with advantage in combination with good culture.

FARMING IN THE NEW ENGLAND STATES.

BY JAMES P. GUNNELL, OF GREENFIELD, MASS.

THE farming in the eastern States is in most respects materially different from that of any other section of this or the Old World, the causes of which are to be found in the condition of the soil, climate, and the peculiar habits and character of the people, inherited from the first settlers, preserved with singular truthfulness, and modified only by the conditions springing from the nature of their position.

The soil is not generally fertile. There is a wide belt of sandy, sterile land along the coast from Rhode Island as far eastward as the Androscoggin river, in Maine. In the interior rocks and gravel, with occasional beds of clay, cover a large part of the surface.

The cultivation of more than two centuries has greatly improved the quality of those portions of the land which have convenient communication with markets, and by the system of railways and the growth of numerous towns and villages this is now very generally extended over the country. Most of the natural fruitfulness was found in the valleys of the large rivers and some of their tributaries. There is no part of New England which is not supplied with water; numerous springs bring it to the surface, rivulets traverse every square mile, and an ample supply is everywhere to be obtained by digging a few feet.

The atmospheric temperature is variable, and heat and cold both in extremes; the mercury ranges from +98° in summer to —22° in winter, the mean being about 46°.

The agricultural season is short, winter lasting through half the year. No verdure but that of the evergreens resists the annual cold, and an unmelted mass of snow often covers the ground for months.

In average years the ground is ready for the plough the first week in April. The average blossoming of the apple is on the 16th of May. Grass is cut from the middle of June to the middle of July; a considerable crop of "rowen," or second growth, is cut in August and September, and is much esteemed, especially for milch cows and sheep. Indian corn is usually ripe in September, and by the first week of November the crops are all harvested.

Droughts, though not uncommon, are not often of great severity. The annual average fall of rain is about forty-two inches.

They by whom New England was originally settled—the Puritans—were a remarkable body of men, possessing an earnest zeal, an iron will, and an immutability of purpose, that have been transmitted to successive generations in a manner as marked as among any other people in history.

Flying from an oppression which they both hated and feared, they shook the dust from their feet against kings and bishops, priests and nobles, determined that their polity should be anything but that of the country they had left. This is undoubtedly one of the reasons of the different tenures of land in Old and New England. The large majority of English farmers hold their lands by

a tenancy—sometimes for a term, oftener at will—occupying farms averaging over 300 acres each in extent, which are owned by a comparatively few of the nobility and gentry.

In New England the average size of the farms is but little over 100 acres, and, as a general rule, every man owns in fee the farm he works.

The farms in the western and southern States are much larger, averaging nearly as much as in England.

Small farms and ownership in fee have doubtless much to do with the general character of the farming. A spirit of independence and self-reliance is fostered in the man by the consciousness that he is the uncontrolled owner of his acres, the result of his own industry and thrift. A greater interest is felt not only in his own farm, but in all social and political matters; habits of attention, observation, and frugality are created; he not only looks sharp after his crops and stock, but equally so to the roads and schools, the taxes, and the expenditure of public money. Most of the labor is performed by himself, and all under his immediate supervision. The result of all this is to be found in increasing prosperity, in better trained cattle and horses, better roads and schools than are found in any other country, or in any other division of this.

The character of the farming is greatly diversified. With the exception of a portion of the Connecticut river valley, where tobacco and broom corn are largely grown, there is no one crop to which farmers turn their whole attention as a specialty, but every farm produces almost all the staples of the country in a greater or less degree. Neat stock; the products of the dairy; almost every kind of the cereals; hay and roots; swine and often sheep, are all grown the same season, on one farm and by one man, whose capital, often too limited to hire labor, consists only of robust health, agricultural skill, close attention, and an unconquerable determination.

The number of farms in New England in 1850 was 167,651, 26 per cent. of the land was improved; the average value of all was $20.27 per acre, this is, however, far short of the real value at present, the improvements made upon land and buildings during the last ten years having been greater than ever before.

The barns of New England farmers have become a most important feature in their agriculture; thousands are annually built on the most approved plans for the storing of hay and other crops, sheltering the cattle, and protecting and saving the manure.

In Massachusetts the number of barns in 1860 was 84,327; an increase of more than 10,000 during the preceding ten years.

Much attention is paid to the preparation and saving of manure. In addition to the regular production of the farms, much is procured on the long line of sea-coast in the form of fish, sea-weed, &c., and great quantities are also carried out from the cities and towns, to enrich the farms; guano and other special manures are also used to a considerable extent.

New England farming has been greatly increased and stimulated by the various agricultural and horticultural societies and associations, of which there were, in 1858, 115, and many more at the present time. Great benefit has been derived from the valuable reports of the Patent Office, and from the seeds distributed from it.

HAY.

The hay crop of New England is not only of the most pecuniary consequence, but it is in other respects, perhaps, the most important throughout the eastern States. All farm stock must be "kept up" for about one hundred and fifty days, and fed with harvested food, the bulk of which must be hay. There is an old Dutch proverb, "No hay, no cattle; no cattle, no manure; no manure, no

crops." We have the manure, and we must have the cattle, and hay is the only staple food we can have; for with our soil, climate, habits, and established notions, we could not successfully feed with straw, roots, and oil cake, as is largely done in England.

By keeping our stock in stables during the long winter we accumulate a large quantity of manure of the most valuable kinds, which goes back upon the tillage, mowing, or pasture land as it is needed, thus not only keeping up, but increasing the fertility of our soil. In a milder climate, where the cattle range out during the whole year, the manure is wasted, the soil impoverished, and crops maintained only by successive application of purchased fertilizers.

The superiority of our working oxen in docility, training, and aptitude for work is owing much to this daily attention, as also the gentleness of our colts, and the ease with which they are broken to work.

The moral effect upon the farming class, especially the younger portion, of taking care of a stock of cattle by inducing thrift, constant attention, increasing vigilance, regularity in feeding, and the necessity of being steadily at home through a portion of the year, which without this would lack sufficient employment, is beyond all calculation, and has greatly tended to the development of those sturdy points which at home or abroad mark the New England farmer.

It is gratifying to know that the hay crop, so essential, is steadily increasing. The amount of hay cut in 1850, 3,463,252 tons, being an increase of about 400,000 tons on 1840, increasing in Massachusetts at the rate of about 10,000 tons a year. The cause of this increase is the advance and improvement in farming, as shown in the reclamation of waste lands, in top-dressing with manure, especially in the fall, in laying under-drains, and by ploughing and new seeding old lands.

The hay crop has not only increased in amount, but has gained in quality by the use of the various machines invented to facilitate its gathering. Mowing machines, hay-tedders, horse-rakes, and hay-caps have immensely lightened the labor and diminished the risk of curing hay. The average of the crop of hay in New England is one ton to the acre.

INDIAN CORN.

The great adjunct of hay for feeding cattle and for fattening is Indian corn, of which there were grown, in 1850, 10,175,856 bushels, an increase of about 500,000 bushels each year since 1840. This crop is all consumed upon the farms, and many thousands of bushels beside are purchased from the west and fed here. The average yield for New England is about 32 bushels to the acre.

The top stalks, leaves, and husks of corn are also highly valued for fodder, and are always stored in barns or stacked after being well cured. With cornmeal for fattening cattle is commonly fed linseed oil meal, which is not always obtained pure and free from adulteration; and also cotton-seed meal, which can be had pure at the Union Oil Mills in Providence, and which is not only fattening, but is the greatest milk-producing food known for cows and ewes, besides adding more than any other feed to the value of the manure.

WHEAT.

The wheat crop is annually increasing, and was, in 1850, 1,090,894 bushels, being at the rate of 15 bushels to the acre. The wheat crop was, a few years ago, neglected, and nearly run out. Two or three unfavorable seasons, and the continued devastations by insects, discouraged the farmers from continuing it; but it has most successfully revived. During the present season 40 and 50 bushels to the acre have been frequently raised in Massachusetts. A like yield has obtained in the valley of the Connecticut, in the States of New Hampshire

and Vermont. Spring wheat, though not so valuable grain, is regarded a safer crop than winter wheat.

RYE.

Rye is an important crop, and is usually grown on light or "plain land." It is extensively used for bread, and also makes a most excellent food for cattle when ground with corn and oats. The average amount per acre is 17 bushels; the whole amount raised is 1,570,589 bushels.

OATS.

Oats are very extensively consumed in the eastern States, to the extent of thousands of bushels more than the production of those States. They are ground with corn for provender, as well as fed whole to horses. The whole amount grown was 9,101,268 bushels; the average yield 26 bushels to the acre.

Oat straw, if not too ripe when cut, is reckoned nearly equal to the best hay as a milk-producing food; the opinion is prevalent that oats are an exhausting crop.

OTHER CROPS.

Buckwheat yields about 25 bushels to the acre, and 716,044 bushels were raised in 1850, the largest part of which is ground into flour for the table.

Barley, which is the least of all the cereal crops here, amounts to 414,496 bushels, yielding about 22 bushels to the acre; it makes an excellent feed; but little of it is malted.

Of potatoes there were raised about 130 bushels to the acre, and in all 19,618,191 bushels. The decrease in this crop has been remarkable. In 1840 the amount was 34,180,500 bushels, and forty years ago premiums were not offered by the agricultural societies for less than 500 bushels to the acre.

The farmers of the eastern States are annually increasing their other root crops with the most beneficial effect. Of turnips they get from 400 to 500 bushels to the acre; of carrots 600; of Swedes and Mangolds 800. There are no statistics to show the amount of these, or of the various products of the garden, which constitute so important a part of the daily food.

The multiplication of manufacturing towns and villages, with their thousands of operatives, has taken hundreds of acres to supply these non-producers with the ordinary vegetable food, returning therefor tens of thousands of dollars, which do not appear in any statistics. So that although by the returns it might appear as if portions of the country were retrograding in some branches of farming, it is, in fact, entirely the other way; for these very products require a higher state of cultivation, which extends to the whole farm.

There are two or three crops which are grown to a considerable extent in some parts of New England, but of which we have no full returns. In Massachusetts in 1855 about 600,000 pounds of tobacco were grown, and in Connecticut 1,267,264 pounds. In Massachusetts 1,841,400 pounds of broom-brush were raised, yielding 156,519 bushels of seed; together amounting to $240,622. The cranberries grown in Massachusetts amounted to the sum of $135,199.

FRUIT.

The cultivation of fruit, especially the apple, is becoming a very extensive and profitable branch of farming. While peaches are an uncertain crop, all the other fruits, common to a temperate zone, flourish, and apples and pears are fast becoming articles of export. In the fall of 1858, and to January, 1859, from Boston alone were exported over 120,000 barrels of apples, four-fifths of which were "Baldwins."

The person who grows good winter apples may be sure of a ready market and a profitable return; the demand for apples that can be kept will undoubtedly increase at home, while new inducements to enterprise constantly present themselves in the increasing demand for exportation for foreign supply.

There is no longer any force in the old objection, that there is no use to raise good fruit because there is no market: the market of the world is open to the American orchardist. The shipment of apples to England is now a regular and a profitable business.

This is a very satisfactory condition of one of the most attractive and interesting occupations of the farmer: every tree he plants attaches him to his farm and home, and the feeling strengthens year by year as he watches its growth and development; even the fertile prairies of the west, attractive as they often prove, will hardly tempt him who can stand in a thrifty bearing orchard, planted and grown under his own care, where every tree is almost as familiar as the members of his household.

Of the winter apples the most popular are the Baldwins, the Rhode Island Greening, Hubbardston Nonsuch, Roxbury, and Hunt's Russet, all of which are of New England origin, are exported to every part of the globe, and are sent often with cargoes of ice to the tropics.

Many summer and fall apples are grown, which find a market for home consumption.

Pears are now cultivated to a large extent, and thrive well with care. It is not possible to estimate the number of pear trees annually transplanted, but for the past ten years it has been immense; in 1855 the pear crop of Massachusetts was estimated at over $100,000, and it would now probably be nearly double that. Pears, rather more than apples, are exposed to the great severity of our winters, or rather to the violent changes from warmth to cold, and the sudden and alternate freezing and thawing, which distinguish the winter and spring of our climate, often proving so destructive to our trees and vines; nor do they so safely bear the droughts of summer.

Many kinds of grapes are sufficiently hardy to ripen in any part of New England, though it is doubtful if any will be found to mature sufficiently to be manufactured into wine to any extent.

Plums and cherries are infested with the curculio and the black wart. Most of the small fruits flourish. Currants and all berries are advantageously cultivated.

The orchard products of Massachusetts alone were, in 1845, $744,540; in 1855, $1,209,405. For the eastern States the value was, in 1850, of all orchard products, $1,609,790.

HORSES.

The horses of New England, for general utility, docility, hardihood, and good qualities as roadsters, have long had a good reputation. They were first introduced to the colonies early after the first settlement, but whatever they were, they did not leave any striking characteristics on their stock; they were improved by occasional importations from England, and also by the introduction of horses from other States.

The attentive observer who has any taste for a horse cannot fail to mark the striking difference in the general character of the horses of different sections of the country. In the New England States is found a compact, hardy stock of horses, of medium size, with high carriage, good travellers. and of an extremely tractable, gentle disposition.

Fifty years ago, when there were no railways in the country and not very good highways, before the building and using of light wagons and other vehicles, when the principal uses of the horse were to drag a lumbering coach six miles

an hour—as fast as it was safe to go—to haul before cattle, to draw the farmer's family to meeting once a week and his grist to mill twice a week, there was small occasion for endeavoring to improve the breeds of horses in this country. Now the times have changed, and we have changed with them; railway travelling makes us seek railway speed, or the nearest approach that we can get, with horseflesh; horses with speed are indispensable as roadsters, and in horses for all work at the present day good travelling qualities are sought.

It is said, with undoubted correctness, that more horses are now sold for two thousand dollars and upwards than were sold for two hundred dollars and over twenty years ago; then one hundred dollars would purchase one of the best horses, now it will hardly buy a young and sound one of any sort.

The breeding of race horses, whether for running or trotting, has, fortunately, never been a profitable business, and never can be so, because, where speed is the sole object, only the fastest few are very valuable, while the remainder are not generally adapted for ordinary service; but there can be no doubt that either fine roadsters, spirited, fleet, and hardy, or a larger, slower horse for draught, might be bred with great profit almost anywhere in New England From the excellence of our roads, and the constant use of light wagons, horses trained to the saddle are not much used and are not much in demand.

There was formerly a breed of saddle horses raised in Rhode Island, and long celebrated there and in the adjoining States as the "Narragansett pacers." Nothing certain is known of their origin, but they are said to have descended from a horse imported by Governor Robinson from Andalusia, in Spain. They were noted for their easy pace under the saddle, docility, and powers of endurance; they were small and not well adapted to draught, and have for some years been extinct.

Within the last half century the attention of agriculturists, and of those who use and like horses, has been turned to the formation of a class of horses for roadsters and also for general utility, and they have to a great extent succeeded in accomplishing this in the "Morgan" and the "Black Hawk" horses.

The "Morgan" horse possesses such an extraordinary combination of good qualities as enables him to excel on the parade-ground as a spirited charger, on the road as a stylish driving horse, intelligent, prompt, and enduring, on the farm as a fine, pleasant, powerful work horse, and on the track as a fast and beautiful trotter. In Vermont, especially, these horses have been bred in great numbers and with considerable care, and they have now become famous all the world over.

The Morgan horses date their origin from a horse owned by and named for Justin Morgan, who removed from Springfield, Massachusetts, to Randolph, Vermont, in 1795, taking this colt with him. So long a time elapsed before his stock was fully appreciated that it became impossible to get an exact pedigree, but he is believed to have a large proportion of English thorough-bred blood from both sides.

The other strain of New England horses, contesting the field with the "Morgans," is that of the "Black Hawk" family, the head of which, the old "Black Hawk," was by some supposed to have been got by "Sherman Morgan," out of a half-bred English mare; but the better opinion is that he was got by "Paddy," a very superior stallion kept at the same stable.

"Black Hawk" was foaled in 1833, and was a beautiful, spirited horse, of almost perfect form as a roadster, compact, symmetrical, and muscular, with handsome head, neck, and limbs. He was perfectly black, and marked all his offspring with his own peculiar excellencies and characteristics, even to color, more decidedly than any other American horse.

Both strains of blood have their admirers, and horses from both are sought for export to improve the horses of other countries and other parts of this.

The number of horses in New England is 212,650.

Mules are but little raised or worked in the eastern States, probably not as much as they should be for economy. Mules were formerly raised in considerable numbers in Vermont, but solely for export.

NEAT CATTLE.

The common cattle of New England were varied in form, character, and color, and had among them none of those uniform characteristics which should entitle them to be styled a "breed." To distinguish them from cattle of improved breeds of recent importation they are called "native," and as having been produced upon the soil are in a measure entitled to that appellation, and there is no impropriety in the use of the term "native bred," when it is understood as not descriptive of any known breed, but only to distinguish the common stock of the country.

The early settlers of the eastern States, coming as they did from different parts of the United Kingdom and of Europe, naturally brought with them, to improve and fertilize the wilderness, the implements and the domestic animals which were regarded as the most desirable in the particular localities whence they came.

The earliest cattle introduced to Plymouth, and the first in New England, were brought in 1624. In 1631 these are mentioned in the old records as having greatly increased. In the meantime a number had been imported for the colonists at Salem.

In 1632 and '33 Captain John Mason, who with Gorges had obtained large tracts of land on the Piscataqua river, made several importations, in his commerce with Denmark, of Danish cattle and horses, which subsequently became largely diffused over the country. These Danish cattle are described in the old records as large, coarse, and of a yellowish color, and it is supposed that they were obtained by Mason as being well able to endure the hardships to which they would be subjected.

They were soon spread among the colonists of Massachusetts bay, and have undoubtedly left their marks on the stock of New England, and are discernible even to the present day, mixed with a great variety of crosses with the Devons, the black cattle of Wales, and Spain, and Holland, and the various other English breeds then unimproved.

These New England cattle make excellent working oxen, being hardy, docile, easily broken to the yoke, and having a tendency to fatten when well fed, while the cows are often superior milkers.

Forty years ago one of the most intelligent, earnest, and liberal importers and breeders of stock in this country wrote of the native cattle of New England as follows: "I am not satisfied that the delicate Devons are any better suited to the yoke than the vigorous and spirited bullocks which are found in Massachusetts and Maine. It has been asserted, and by authority which I am always disposed to respect, that the cattle of Massachusetts are derived from the Devons; but Lancashire, Leicester, and Hereford blood can be traced by a practiced eye in many of the best working oxen exhibited at the New England agricultural shows. If color determine the question, it is but fair to state that from one hundred yokes of the finest draught cattle of Massachusetts which were last autumn (1822) exhibited at the Worcester county show, the best were taken to Brighton, where a pair of very light yellow oxen received a premium for docility and speed at the plough. On a former occasion a yoke of black and white bullocks received the award. The most hardy, active cattle I have seen had the shape of kyloes, and were brown. In activity, patience, and strength have the cattle of Great Britain ever surpassed the cattle of Massachusetts? I have never seen in Europe performances of oxen comparable to that which in Massachusetts would scarcely be remarked."

Massachusetts is distinguished for the number as well as the character of her working oxen. The State census, taken with great accuracy, shows 78,000 working oxen and steers within her limits.

In the mixed farming of the eastern States cattle are bred for the three purposes of the dairy, the draught, and the shambles. In the vicinity of the cities and large towns the great object desired is the quantity of milk, rather than the quality, fitness for breeding, or aptitude to fatten. In other parts more remote farmers desire a stock that will yield a better quality of milk for dairy purposes, break easily to the yoke, grow rapidly, and fatten early.

A stock of cattle that would suit one farmer might be wholly unsuited to another; and in each particular case the breeder might have some special object in view, and select his animals with reference to it.

As the short-horns attained the largest size in the shortest time; as Hereford steers made admirable beef; as the Devons made the most active working oxen; as the Ayrshire exceeded in quantity of milk, and the Jerseys in quality, it long ago seemed desirable to introduce those established breeds from England for pure breeding here, and for crossing upon our so-called native stock, which has been done by some of our farmers with great success.

Among the farmers of the New England States probably short-horn grades are largely predominant, as coming nearer to the general requirements of the people than any other. They are kind and docile, easily broken to the yoke, grow rapidly, and mature early, and some of them are excellent milkers.

Grade short-horn bullocks have been killed weighing alive 3,400 and 3,500 pounds, and it is not uncommon to see them weighing from forty-five to fifty hundred pounds a pair, as they are thrifty, hearty feeders.

The fitness of any farm stock for the general uses of the country must be determined by the returns derived from the comparative consumption of food; for that must be the test, as it would be in vain to select expensive beasts, which, by their graceful forms, large frames, or fashionable points, attract the notice of unpracticed men, unless it can be shown that less food is required for their stomach, more butter derived from their udders, more flesh from their loins, less offal with their bone, and a quicker return made, by their early maturity, to the breeder's pocket.

Large numbers of cattle were formerly fed to a high state of excellence for Brighton market, at paying rates, but the facilities for bringing cattle at all times by railroad from the west, and other States, are so great, that the business is almost abandoned, and farmers are feeding sheep to a considerable extent instead, which is much more profitable and sure. The whole number of neat stock was 1,496,028; of these 608,249 were milch cows, 293,235 were working oxen, and the remainder steers, heifers, calves, &c.

SHEEP.

For sixty years the raising of sheep and the growing of wool have had a very prominent position not only in the agricultural, but also in the political history of the eastern States. Wool being one of the great staples upon which our manufacturing interests are dependent, the protection and encouragement of which have sometimes changed the politics of the country.

While from a period in English history as early as the twelfth century sheep, wool, and all the manufactures of that article, were by legislation and royal edicts carefully fostered and sedulously encouraged, as a part of that same policy they were ever discouraged and frowned upon in the colonies of that powerful and far-seeing nation, which has ever sought to make the whole world tributary to her manufactures.

At the close of the war with Great Britain we found ourselves not only without manufactories of woollens, but also destitute of the material upon which to

work. The attention of our statesmen was early called and directed to supply this deficiency, and they wisely looked to the Merinos of Spain to do it; but for a long time they sought in vain, the Spanish government refusing to allow any exportation of them.

The first pair was brought by William Foster, esq., then of Boston, in 1793, who smuggled them on board an American ship, from which, after a long voyage, they were landed in Boston.

In 1802 General David Humphreys, of Connecticut, when minister to Spain under Mr. Jefferson, imported, by leave of that government, a flock of two hundred, which he bred and increased with such success as in 1807 to have had made several hundred yards of fine cloth, for which he received a gold medal from the Massachusetts Society for Promoting Agriculture. Chancellor Livingston, of New York, imported a few, and in 1809–'10 the late Hon. William Jarvis, of Weathersfield, Connecticut, imported very largely, and to him more than to any one is due the rapid advance in the manufactures of fine wool, which for a time were pursued with more zeal than discretion, subordinating every other branch of agriculture to this.

It is probable, however, that otherwise agriculture was benefited in an indirect way; the mechanical skill evolved in making and running the machinery for manufacturing wool was soon directed in other channels, and began to develop itself upon agricultural tools and implements, till finally it has culminated in those beautiful machines which enable us to cut our hay and harvest our grain, almost independent of the supply of labor or the changes of the weather.

After the Merinos, the Saxony sheep were introduced, under the idea that coming from a region so far north they would be hardy, and suitable for the climate of New England. The results did not justify the expectations of those who imported them; although the wool is of superlative fineness, the sheep are not sufficiently hardy for this region.

Previous to the introduction of the Merino, the only sheep known here were called "native sheep," although imported at some time long before from England; they were of two kinds, white faced, often with horns, and dark or speckled faces; it is not improbable that these last, which were called "Irish" or "English Smuts," were "South-downs," imported before the improvement of that celebrated breed had commenced, as they bear many of the original characteristics of that breed.

Sheep were brought to the Plymouth colony in 1628. In 1658 Mr. John Joselyn, in his "Voyages," speaks of them as plenty. In 1676 Sir Edmund Randolph, one of the provincial governors, speaks of New England as abounding in sheep.

Within the past few years great pains have been taken to improve the quality of the sheep for the shambles; generally in the eastern States it is more profitable to breed and to feed sheep than cattle, and the best English breeds have been introduced and bred upon our "native sheep" with great success; the Cotswolds and Leicesters for mutton, and the South-downs and Oxford-downs for lambs.

The Leicesters and Cotswolds have been mostly brought here from Canada and northern New York, and have been so crossed with each other and with other breeds that it is almost impossible to find them pure bred. More care has been exercised in breeding the South-downs, and the importations of Mr. Thorn and others have vastly improved our flocks.

The Oxford-downs are a breed made in England within thirty years, by a judicious intermixture of South-downs, Cotswolds, and Hampshire-downs. They were first imported by Mr. Fay, of Linn, in 1857. They have an equal fineness, hardihood, aptitude to fatten, fecundity, and excellence as nurses as the South-downs, with more size and fleece.

Raising early lambs for market is a considerable and a profitable branch of farming. Lambs dropped in February from good ewes, and fed with meal, are fit for the butcher in May, fetching from five to six dollars each; those dropped later and sold from grass, having no grain, fetch from two and a half to four dollars.

The number of sheep was, in 1840, 3,820,307; while in 1850 it was 2,257,583. This great diminution in numbers, however, does not extend in like proportion to the value; for while the loss in numbers was 41 per cent., the decrease in value was only 25 per cent.

The quantity of wool grown in New England was, in 1850, 7,085,509 lbs.; in 1840, 8,440,909 lbs. It will be seen here, too, that the decrease is by no means so great as in the number of sheep, being a loss of one-sixth of wool to two-fifths of sheep.

The diminution of sheep in the different States is as follows: Maine, $\frac{1}{3}$; New Hampshire, $\frac{3}{5}$; Vermont, $\frac{4}{10}$; Massachusetts, $\frac{1}{2}$; Rhode Island, $\frac{1}{2}$; Connecticut, $\frac{7}{12}$. This change is partially accounted for by a gradual substitution of smaller flocks of larger sheep, bred for mutton and lambs, in place of the fine-woolled sheep, which are not profitable for the shambles. Even the splendid Merinos of Vermont, so long the pride of the Green Mountain farmers, are yielding to the large English breeds. The alterations in the tariff, the fluctuation in the price of wool, and the great destruction of sheep by dogs, have all operated to reduce still more the flocks of fine-woolled sheep. An increasing demand for mutton, and the steady rapid advance of coarse and middle wool in price, with stringent laws for the protection of sheep against dogs, are now all successfully operating to encourage in New England the universal growth of this most useful of the domestic animals.

SWINE.

The number of swine raised, and the quantity of pork made in New England, is far less than formerly. The high price of grain here, and the ease with which the still-slop-fed hogs of the west are rushed from the Mississippi to the Atlantic, have rendered the raising of hogs for market generally an unprofitable undertaking.

Salt pork is not made the unvarying staple upon the farmer's table as it formerly was, although still a most important element in New England housekeeping. The thicker settling of the country, and the more frequent interspersion of villages, leads to a more general distribution of fresh meats, so that the farmers are not now, as formerly, so entirely dependent on the meat of their own killing and their own pork barrel.

Of the origin of New England hogs nothing particular is known. About thirty-five or forty years ago a breed was made up, called the "Mackay," which left its mark wherever it went, and was bred long enough, it was supposed, to render its characteristics permanent, but it is doubtful if it can now be found pure. It was a very desirable breed of hogs, and it is a great pity that it has been allowed to degenerate.

The "Berkshire" hogs were introduced here at one time, but on account of their black color and unprofitable shape were not generally popular with the farmers.

The Messrs. Stickney, of Boston, did good service in importing the pure bred Suffolk hogs from England, which were disseminated all over the country, and introduced a most decided improvement among the common hogs of the country by crossing. They fatten very readily, but do not get the size as desirable and profitable for farmers.

The Chester county hogs seem at the present time to be the most in favor

with the farmers. If allowed, they will fatten early, or they can be kept growing to a very great size.

The number of swine in 1840 was	748,698
The number of swine in 1850 was	361,491

POULTRY.

The poultry of the various farms of New England forms no inconsiderable article of food and profit; and though always considered a favorite and delicate article of food, it is only within a comparatively recent time that the attention of agriculturists has been turned to the introduction of new breeds, and to the improvement of the old ones long kept among us. But of late years this subject has received much attention; the number of breeds has been largely increased; all the poultry of the country has been improved, and the use of it for food become much more common than formerly. Probably, in Boston alone, not less than a million and a half of dollars' worth are annually sold.

It is now fully shown by our agricultural reports that poultry may be made a source of profit, exceeding any other investment on the farm, in proportion to the expense, and that a well-managed poultry yard will contribute its full share to the profits and comfort of the farmer; while as a branch of rural economy it is exceeded by no other in the interest and pleasure derived from it.

The statistics are very incomplete, indeed there are none since 1840; but imperfect as they are, they would astonish any one who had not paid attention to the subject. It is estimated that the city of New York expends more than a million and a half of dollars for eggs alone. It is probable that since the returns of 1840 the poultry of New England has doubled in amount and value, for it has certainly been vastly improved by the introduction of foreign breeds, and a great interest has been created in poultry breeding.

Turkeys have been very much increased in size and improved by the infusion of wild blood from Canada and the west; and where this splendid bird becomes once in the year a religious necessity to almost every one of the half million families of New England, it is something to have increased its size full thirty per cent.

The value of the poultry of the New England States for 1840 was $778,329; it is now nearer $2,000,000.

DAIRY.

In a region of country having so large a proportion of grazing lands it is, as would be expected, that the products of the dairy should form a leading source of income of the farms.

The whole amount of butter and cheese in 1850 was 71,045,784 pounds, amounting to about $9,946,409—an enormous sum, and still increasing.

The milk business has also grown to become one of no small consequence. The network of railways spread in all directions over New England has opened facilities for sending speedily to market farm products of every kind, not the least of which is milk, which is sent in immense quantities to the cities and large towns in tight cans, packed in ice in summer. The benefits from this to the crowded inhabitants of a city, relieving them from the abomination of distillery-fed milk, and furnishing it fresh and pure directly from the green pastures of the country, are incalculable. We have no data as to the rest of New England, but the sales of milk in Massachusetts alone, for the year 1855, amounted to over $760,000.*

MAPLE SUGAR.

The strictly agricultural portions of the eastern States are not entirely dependent on slave labor, or the sugar cane, for their sugar. The maples of their

* This branch of the subject is fully treated in Mr. Loomis's paper on milk in this volume.

own rocky hills furnish no insignificant supply of saccharine matter: 8,588,111 pounds was the amount made in the year 1850, though in some years it is larger, depending very much on the character of the season.

The rock, or sugar maple, is the one from which the sugar is obtained by boiling the sap, and there is undoubtedly much difference in the quality of the sap, arising from the different natures of the soil and the trees themselves.

Maple trees ought not to be tapped till they are fifteen or sixteen inches in diameter, and then they do not seem to show any decay of vigor for a long series of years. The trees are usually tapped with a half inch auger, or bit, from four to eight wooden spouts being inserted, according to the size of the tree; the sap is collected in buckets from the spouts. A large tree, with a full number of spouts, will yield a barrel of sap, from which eight pounds of sugar may be made. It is boiled in shallow pans, requiring about an hour's time to reduce a barrel of sap to eight or ten quarts of thick syrup, which is then boiled down in another kettle till thick enough to granulate, when, having been previously clarified by the white of eggs, or sometimes with skimmed milk, it is poured off into moulds and soon hardens. It is essential that all the vessels used, buckets, barrels, kettles, &c., should be strictly clean. The work when commenced commonly goes on day and night, till the season is over, which is usually in two or three weeks. A cord of wood will boil from 100 to 200 pounds of sugar.

The sugaring season is commonly in March, and comes at a time of the year when farmers are less occupied with other operations than usual, and although hard work, requiring constant attention, is generally made an occasion of much social enjoyment.

Maple sugar is often whitened by being drained, a wet cloth being placed on top of the mass and opportunity being given for the syrup to drain away. This, while making the sugar look very white and handsome, detracts much from the peculiar flavor and diminishes the saccharine matter. Maple sugar is much used in farmers' families for ordinary purposes of the household, and the syrup is the most delicious kind of molasses, readily selling at about a dollar a gallon, and the sugar from ten to twenty cents per pound.

The farmers of New England, placed upon an unfruitful soil and in an uncongenial climate, have increased, thriven, and wrought out for themselves prosperity and a good name. They love the homes they have created and the rugged hills from which they have compelled their sustenance and their substance; but they love them only as a part of the whole country, and when a disruption of that is threatened, their rough hands, that had never wielded anything more warlike than a ploughshare or a pruning hook, are the first to beat those peaceful implements into the sword and the spear, and with prompt alacrity to hold at bay the traitorous assailants of the capital, of liberty, and the Union.

INDIAN CORN.

BY LEWIS BOLLMAN, BLOOMINGTON, INDIANA.

When Linnæus gave to Indian corn the botanical name of *Zea mays*, from the Greek word *zao*, to live, he chose the most appropriate that could have been given to it, for of all plants adapted to the support of animal life it is the first.

As a food for the human race, its nutritious qualities compared with those of wheat are as 77 is to 95, whilst its general average price is but one-half only.

No preparation of which wheat is susceptible can equal the cheap and nutritious breads from corn. What the potato is to Ireland Indian corn is to the world. To the poor and the rich, the sick and the well, whether in starvation or in abundance, it is more truly "the staff of life" than wheat.

This cheapness and its superiority in oils adapt it to the fattening of stock; and without it what could the American farmer do by relying on root crops, so uncertain in our irregular climate, and so costly where low-priced labor does not exist? Without it, what would become of that vast internal trade based upon cattle and hogs? In what other way could the employments and transportation connected with that commerce be sustained?

But the superiority of Indian corn does not consist alone in its cheapness and nutritive qualities, for in its adaptation to climatic extremes it is not less superior. It occupies a wider range of latitude and elevation than any other cereal. It is found on the high and dry plains of Mexico, in the low and humid valleys of the Amazon, at the equator, and in the Canadian provinces, and wherever the mean temperature of the summer months is not below 68°. It was consecrated to their deities in the public worship of the aboriginal nations of this continent, and is a fitting theme for the inspiration of our best poets. The Christian who daily acknowledges his dependence on the Beneficent Creator of all things finds in no plant so strong evidence of his good will. Accurately, then, did Linnæus name it, for by it we *live*. Its inherent properties foreshadowed to him its vast production and its unequalled uses and benefits.

THE VALUE OF THE CORN CROP

To show that this estimate of the importance of this cereal is not excessive, as well as to set forth important facts connected with its cultivation, I refer to the statistics of the agricultural productions of our country. "For figures," says a writer, "are not always fleshless as skeletons. They have a very present life in them, and may carry with them a fascination beyond the figures of speech. It is a simple work, perhaps, the putting them together, but once rightly arranged they hold the most significant meanings." And no figures, I may add, have more significant meanings than those exhibiting the magnitude of the corn crop.

The census returns of 1850 show the amount of the leading agricultural products to be as follows:

Products.	Quantity.	Price.	Value.
Indian corn.....bushels.	592, 326, 612	$0 77	$456, 091, 491
Wheat.....do...	100, 503, 890	1 56	156, 786, 068
Hay.....tons..	18, 839, 579	13 50	254, 334, 316
Cotton.....pounds.	987, 449, 600	12	118, 393, 952
Tobacco.....do...	199, 752, 646	12	23, 970, 317
Rice.....do...	215, 312, 710	4⅓	9, 326, 884

These prices are the average prices at New York for the years 1855, 1856, 1857, and 1858. They, of course, represent the aggregate value of each crop much greater than it really is, but they truly represent the *comparative* value of each crop, and for that purpose only I refer to them. If these crops were shipped to that market, it may truly be said that a larger portion of the value of corn than of any other of these crops would be made up of the cost of transportation. But, on the other hand, it may be as truly said that it is so trans-

ported in a more compact form, as live stock, beef, pork, tallow, lard, bacon, butter, and cheese. It will be seen that the united amounts of the wheat, cotton, tobacco, and rice crops are not more than two-thirds of the value of the corn crop. The census returns of 1860 and the average actual prices of every city market would not lessen this comparative result, but rather enlarge it, for the corn crop it is believed will exhibit a greater per cent. increase in the last decade than any other crop.

THE INTERNAL TRADE DEPENDENT ON THE CORN CROP.

But the corn crop has a value independent of its money value. It is a *national crop*, not only because it is so extensively grown, but because it is transported and consumed in all parts of the Union, not as corn only, but also in the form of other products it creates. To illustrate this national value I refer to the pork trade.

The estimated amount of pork that enters into the commerce of the country is 323,358,800 pounds, of which 184,386,409 pounds are consumed in the southern States, from 80,000,000 to 100,000,000 are exported to foreign countries, and the balance principally consumed in the eastern States.

The beef trade is not less, nor less circumscribed, but its dependence on the corn crop is not so absolute. Still it is in a great degree dependent on it, not only on the grain for fattening, but on the fodder, by which the immense herds of the cattle of the west are wintered.

What a dependence! As a breadstuff, its millions of bushels sustain us; and changed into beef and pork, its hundreds of millions of bushels are represented in that provision trade that gives so much employment to drovers, butchers, packers, coopers, saltmakers, and so vastly increases the carrying trade of our railroads and steam vessels.

The internal trade of our country, so dependent on agriculture, has never received that consideration its magnitude demanded. The statistics of the amount only of production have been taken, but not of that reciprocal exchange which constitutes our internal commerce. Our political men have been accustomed to regard the importance of our agricultural crops as indicated by our foreign commerce only. Cotton, being the chief article of export, has usurped the prerogatives of "king," and exercised a controlling influence over our political affairs. Had the statistics of our internal commerce been collated and properly arranged, they would have exhibited "significant meanings," showing to the American people that vast mutual dependence of each portion of the republic on the other, and the controlling influence which each exercises over the happiness and prosperity of the other.

THE EXPORT TRADE OF CORN AND ITS PRODUCTS.

The export trade of a country is often important when its amount is not great, for it may prevent that depression of price which a small surplus may create. The exports of corn and cornmeal for the past eight years have averaged about eight millions of dollars annually, and of pork, bacon, and lard, about eleven millions. Immediately after the famine in Ireland of 1847, hopes were entertained that the export trade of corn and meal would greatly and constantly increase, but they have not been realized, although the nutritive value of corn is about one-fourth only less than that of wheat, whilst its price is but half as much. But this inherent value of corn has not been able to overcome the tastes acquired in youth for oatmeal, wheat bread, and the potato, which constitute the food of the poorer classes of England and Ireland. Besides, it is difficult to ship to European countries the corn and meal so as to preserve that pleasant taste peculiar to new corn and meal, and which exposure to the atmosphere so rapidly takes away, especially if the atmosphere is moist and confined

as it is in the hold of a ship. But even here corn bread must be made with materials not always within reach of the poor of Europe, and eaten with the products of the dairy, which, in times of short crops, they cannot purchase. If the foreign consumption of corn is to be increased, it must be as mush and fried mush, both easily cooked and agreeably consumed with the accompaniment of molasses. Nor is there any food which so completely sustains the wants of the laborer as mush fried with lard. It is both meat and bread, and its use is unaccompanied by a craving for meats, fruits, or vegetables, as is the case where wheat bread is used.

But looking to the important uses of corn at home, is it desirable to increase its export? Would it not result in such advanced prices here as would render it unprofitable to feed to stock? The pork product barely sustains itself, as seen in the fact that in Ohio and Indiana the maximum in hog raising has been reached. Would not its increased exportation diminish that of wheat and flour?

It may be said, in answer to these inquiries, that an increased demand would be met with an increased production, thus supplying the home demand, and preventing that augmentation of price which otherwise must necessarily follow. This reply obliges me to look at the corn crop in a very different light than I have so far done. It may be gratifying to our national vanity to dwell on the magnitude of this great staple of our country, and exultingly to imagine, as has often been done, that our capabilities of production are so unlimited that we can feed the world. No opinion could be more erroneous. Every reflecting man knows that these vast millions of bushels of corn cannot be grown without a deterioration of the soil, and every intelligent agriculturist sees that this exhaustion is rapidly becoming impoverishment. Let us inquire, then, to what *extent* corn cultivation has exhausted the soil; *how* it produces exhaustion; and *what culture* may best remedy the soil.

THE CULTIVATION OF CORN AS AN EXHAUSTING CROP CONSIDERED.

The corn crop is one of the "clean crops," and all such are considered to be exhausting. They are called *clean* because they must be kept clean of weeds and grass, and therefore require repeated ploughings during the summer. The principal crops of this kind, in the northern and western States, are potatoes, corn, and tobacco, and in the southern States, cotton, tobacco, and rice. The effect of tobacco cultivation in Virginia shows that the most fertile lands are rapidly exhausted by it, and that the temporary prosperity its cultivation gives has been followed by permanent adversity. A writer in the Patent Office Report (Agricultural) for 1860, speaking of the exhaustion of southern soils, says:

"The southern system of agriculture includes a succession of crops of a most exhausting or otherwise injurious character. These crops are cotton and corn, varied only by small grain. This succession is continued until the land is worn out and turned out to rest."

Corn cultivation in the west has been followed by the same detrimental results, especially upon the uplands. Mr. E. P. Cranch, secretary of the Cincinnati Horticultural Society, draws from the agricultural statistics of Ohio, among other inferences, the following: "That the number of acres now cultivated in corn in that State is about two and a half millions, averaging about twenty-eight bushels to the acre in the last four years; that the average yield per acre is on the decrease, whilst the number of acres cultivated is steadily increasing; showing that in ten years the farmers have not improved in their modes of culture, as a general rule."

The average production of corn per acre, in Ohio, from 1850 to 1858, both included, was thirty-three bushels, and in the rich valleys of the Miami and the Scioto but thirty-six bushels. Take, in connexion with these statistics, the fact that from 1850 to 1860, new lands to the amount of 3,200,452 acres were

brought into cultivation in Ohio, nearly all of which are devoted to corn cultivation, and a better general idea may be formed of the exhausting character of this crop.

Again, the wheat crop in Ohio is gradually decreasing, both in the acreage sown and its average yield. "This," the intelligent secretary of the Ohio State Board of Agriculture says, "has not been occasioned by the wheat lands having been converted into corn lands, but by changing them into meadows and pasture lands. The additional grounds which have been devoted to corn are such as have recently been reclaimed from a state of nature." Wheat is not an exhausting crop when compared with the clean crops, and the impoverished condition of the wheat lands in Ohio can be attributed to no other cause than their prior cultivation in corn. That State seems to have reached its maximum of grain production, and fast becoming, as New York, a grazing State.

In Indiana grain production is but slowly on the increase, although stimulated by its network of railroad transportation. The corn crop of 1857 was the greatest the State ever produced. The next decade will show that its maximum of grain production has also been reached.

These facts have "significant meanings," for they imperatively demand an abandonment of our present modes of cultivating the corn crop. The next inquiry, therefore, must be

IN WHAT WAY DOES THE CULTIVATION OF CORN EXHAUST THE SOIL?

There are but two ways that corn or any other crop can exhaust the soil—by what it takes from it in the growth of the plant, and by what its cultivation destroys in the soil. I will consider these in the order stated.

1. *By what the plant takes from the soil.*—The analysis of the grain of corn shows it to be rich in the most fertile elements of the soil. Dr. Dana states that 100 pounds of corn have 88½ pounds of fat-producing elements, whilst that number of pounds of ruta-baga have but 13, and of potatoes but 24½ pounds. The potato crop is conceded by all cultivators of it to be very exhausting. Let us compare the fat-producing elements taken from an acre of potatoes yielding 150 bushels with those of an acre of corn of 50 bushels.

According to the statement of Dr. Dana, this amount of potatoes, at 60 pounds to the bushel, would weigh 9,000 pounds, of which these elements would constitute 3,650 pounds. An acre of ground that would yield this amount of potatoes will produce 50 bushels of corn, making 4,425 pounds of fat-producing elements; being 775 pounds more than the acre of potatoes, or more than one-fifth greater.

Analyses of the organic and inorganic constituents of corn will more fully exhibit its exhausting effects upon the soil. According to these analyses, as stated by Dr. Salisbury, of Albany, New York, the organic elements in 100 grains, are:

Gluten	4.62
Albumen	2.64
Starch	41.85
Oil	3.88
Casein	1.32
Dextrine	5.40
Fibre	21.36
Sugar and extract	10.00
Water	10.00

The inorganic elements, are:

Carbonic acid	trace.
Silicic acid	0.85

Sulphuric acid	0.57
Lime	0.07
Magnesia	17.60
Potash	23.17
Soda	3.60
Chlorine	0.29
Organic acids	5.70
Phosphoric acid	49.21
Sodium	0.16

From these it will be seen that the most valuable elements of a rich soil enter into the composition of the grain of corn, as magnesia, potash, and phosphoric acid. The proportion of oil is very great, to which is to be attributed its superior fattening properties. Its production, therefore, is at the expense of "the fat of the land," and hence, with much truth has Mr. Calvin Leavitt, in the Massachusetts agricultural reports, who, having applied thirty-five dollars' worth of manure to an acre of land yielding 89½ bushels of corn, said, "that he had not given the corn any credit for one-half the manure not exhausted, as many do, for it is a great tax on any other crop to find this other half after raising a hundred bushels of corn per acre." My own experience corroborates this statement.

Compared with the wheat crop, we find corn far more exhausting. The nutritious elements of corn being to those of wheat as 77 is to 95, and as the average production of corn to the acre is double that of wheat, the direct exhaustion of corn to that of wheat is as 154 is to 95.

2. *By what its cultivation takes from the soil.*—The first intimations that the farmer has of the wearing out of his soil is its liability to bake and its inability to withstand drought. In times of drought every old settler is speaking of the change of our climate, but the general remark is that whilst the corn in the old fields is wilting that in the new grounds is doing well. What, then, is it in new grounds which resists the droughts of our hot summers?

When a farmer clears new grounds he finds them full of the roots of trees and undergrowth, of decaying logs, and covered with many layers of leaves. These form what is called the carbonaceous matter of the soil. When these are partially decayed they are called *mould*, and in this state resemble charcoal. "Mould," says Mr. Dana, "is the half-way house of decay." It remains in this state of partial decomposition before the forests are cleared for want of light and heat; but when the axe has removed the trees, and the plough has turned up the soil, exposing this mould to the rays of the sun, it then receives that light and heat essential to complete the process of decay. It is then gradually resolved into gases—the form in which it enters into vegetation.

Although soils absorb these gases, the principal one of which is carbonic acid, yet the rapid decay of so much mould forms more gas than the undecayed portions can absorb. It passes, therefore, into the atmosphere, and is lost to the land which produced it. The cultivation of a corn crop requires five ploughings usually, which are given to it when the atmosphere is hot and moist and its agencies to accelerate decay most active.

It is almost impossible to determine the relative exhaustion of these two causes; but observation leads me to the belief that the cultivation of the corn crop is much more deleterious to the soil than the impoverishment consequent to the growth and removal of the entire plant—the stalk as well as the grain.

Exhaustion, then, seems to be chiefly occasioned by the destruction of mould. It becomes important, therefore, to examine into its agency in the production of crops, that we may learn whether its loss can be supplied, and, if so, how.

Its productive action is threefold—by its change in decay to carbonic acid gas,

by its power of absorbing this gas from the atmosphere, and by its action as a non-conductor of heat. Of these in their order.

OF THE ACTION OF MOULD IN THE PRODUCTION OF CROPS.

1st. The change of mould into carbonic gas has already been shown. Whilst nothing on earth can be annihilated, change, especially of vegetable and animal existences, is constant; and that change is simply to enable living matter to exist from dead matter. It is resolved into gases, and these pass into the living plant, again assuming a solid form. Mould thus sustains growing vegetation, for it is the remains of a previous living vegetation. The greater the amount of this mould the more can vegetation be sustained. The reverse is equally true.

2d. The absorbent power of the soil has been demonstrated by Liebig. The air constantly receives vast quantities of carbonic gas. Animal life, when it inhales the air, takes from it oxygen, which unites in the lungs with the carbon of the venous blood. Their union forms carbonic gas, which is thrown into the atmosphere with every exhalation of the breath. When fallen trees, leaves, grass, and other vegetable matters decay, all their wood forms carbonic gas by uniting with the oxygen of the air. Let the farmer think for a moment what an enormous amount of this gas is thrown into the air when he burns the log-heaps of a ten acre clearing. The coal and wood burnt in our houses and manufactories fill the air with it; and so great is the quantity from these different sources that the atmosphere would soon be unfit to breathe, had not nature provided means to take it out of the air as fast as it comes in. The rains absorb it and carry it into the ground. The leaves of trees and vegetables, and the blades of our grasses and cereal crops, absorb it. But the greatest absorbent of all is the soil. Its power in this respect is its most useful as well as most extraordinary one. Nothing more wonderfully exhibits the infinite wisdom of the Creating Power.

Do all soils alike possess this power, or is it limited to certain parts of them only? is a question of great practical utility to the farmer. Fortunately, it is a question that he can easily determine. He may plough deeply; he may stir the soil frequently; he may subject it to the ameliorating influences of freezing; and this in the vicinity of rich alluvial lands or decaying forests, or of rivers or marshes exhaling carbonic and other gases—it will all be in vain, if the soil is worn out. Clays or sands destitute of vegetable matter will not absorb them. Our railroad excavations furnish many instances where the top soil has been taken away in their construction, and the farmers have ploughed these places for years and planted them with the vain hope of gradually forming a productive soil, and this where the air was fertile with carbonic gas. The soil was destitute of carbonaceous matter.

Charcoal is a well-known absorbent of gas. If tainted meat is put in it, it soon becomes sweet. Hence it is used as a disinfecting agent. And mould, as already stated, is charcoal, and possesses its absorbent power. Nature has thus invested it with a double agency in furnishing plants with carbonic gas by its own decay, and by absorbing from the atmosphere the carbonic gas exhaled into it. Its value, therefore, cannot be over-estimated, for, as Dr. Lee has truly said, "in every barrel of flour or meal (196 pounds) there are not far from 186 pounds of carbon (coal) and the elements of water."

3d. The agency of mould as a non-conductor of heat is of not less value to the corn crop than both those I have just considered, for by this negative condition it protects the crop from the droughts so peculiar to our climate. Let us examine this matter fully, for no question is more important to the successful growing of corn than its protection against drought. The statistics of Ohio and Indiana are instructive as showing the disastrous effects of drought upon it. The seasons of drought have been alternate since 1854, and the average yield per acre

in Ohio has been as follows: 1854, 26 bushels; 1855, 39½ bushels; 1856, 27½ bushels; 1857, 36½ bushels; 1858, 27½ bushels. In Indiana, the acres planted are not returned in the State statistics, but the entire crops have been as follows:

	Bushels.
1854	34,811,902
1855	58,126,259
1856	39,833,366
1857	59,793,657
1858	37,261,622
1859	54,045,217

Here we see a general decrease of full *one-third*, occasioned by *drought alone* To show what kinds of soil are most affected by it, I give some details of an experiment made by me in 1860. Wishing to raise a crop of 60 or 70 bushels to the acre, I manured highly about 4 acres. In them was a fence-row that had never been ploughed but once, and had been permitted to grow up in bushes and briars. It was full of mould, and thus represented our new grounds. On one side of it there was about half an acre, about half worn. On the other side was about a quarter of an acre which had been made very rich with stable manure, put on ten years previous. The other portions were very much worn out, but I manured nearly all of them bountifully with unfermented manure, leaving a portion, however, unmanured. I ploughed it from ten to twelve inches in depth, at places turning up the sub-soil, which has but little fertility and no mould. It was drilled, and planted on the 9th of May. Soon after the corn came up, a drought set in, and the most of it soon ceased to grow. It was affected by the drought in the following order: 1st. The poor, unmanured portion, and where the sub-soil had been upturned. 2d. The recently manured portion. 3d. The old manured portion. 4th. The half-worn soil, unmanured. 5th. The fence-row, also unmanured. The last seemed but little affected by the drought. The corn continued to grow, with a broad leaf, retaining a deep green color. Copious rains followed this drought, saturating the loose ground, which was at least 15 inches in depth. The corn started to grow finely in the reverse order from the above. Then followed another and severer drought, during which the corn tasselled. All of the tassels were burnt dry on all portions except the half acre about half worn, and the fence-row. On No. 1, as above particularized, the stalks were very small; on No. 2, much larger; on No. 3, very good; on No. 4, not so large as No. 3, but most of the tassels were uninjured; on No. 5, the stalks were good and no tassels destroyed. No corn was made except on the two latter portions—on No. 4, but an indifferent crop; but on No. 5, the corn was good. During the first drought I ploughed with the cultivator Nos. 1, 2, and 3, but not 4 and 5. I could not perceive that this ploughing affected the corn in any way. A neighbor manured a field the same season, much less bountifully, however, and did not plough it half the depth I did mine. His land was also much worn. He raised a moderate crop, but my grounds lay strongly exposed to the sun; his on a hill-side, rapidly sloping downwards to the north, and hence was but little affected by the sun.

From this experiment, as well as from my general experience, I draw the following conclusions: 1st. That ground made rich by barn-yard manure is easily affected by drought, whether manured recently or not. 2d. That soil destitute of mould cannot withstand droughts, no matter how deeply ploughed. 3d. That it is this mould which protects the corn crop against the effects of droughts.

An examination of the nature of mould will sustain the last of these inferences. It is a partial decay of vegetable matter, partaking of the nature of charcoal. Sawdust, straw, tan bark, and charcoal are most commonly used as non-conductors of heat, to form ice-houses and to mulch trees and growing plants. Every farmer knows that underneath rotten wood the soil is moist and

mellow. Now, in all these various uses of vegetable matter, their action is the same; they are non-conductors of heat. Hence a soil abounding in mould is a non-conductor of heat, and thus the soil about the roots of our crops is kept cool and moist.

And these remarks bring me to the consideration of a question all important to the cultivation of the corn crop, namely:

FROM WHAT SOURCE DO PLANTS DERIVE MOISTURE IN TIMES OF DROUGHT?

Until within a few years past the universally received opinion was, that moisture, except from rains, was derived from the atmosphere. Considerable observation satisfied me that this opinion was erroneous. Thus, for instance, it is usual in the west to see green poplars left in the field on account of their value. Around them corn is planted, which grows very well until a drought sets in, when the blades soon begin to wilt and the balance of the corn rapidly outstrips this portion in growth. It was common to say that the shade caused this wilting, but on the south side of the tree, where the corn most wilted, there was no shade. If the moisture was derived from the atmosphere this corn should not have wilted more than any other portion in the field, but the tree should have suffered. So grass around trees always dries up sooner than that which is in open fields, when dried by drought. These facts can be accounted for upon the supposition only that the moisure comes from the subsoil, and in its upward ascent, drawn by capillary attraction, the lower roots of the trees appropriate it, leaving an insufficient portion for the surface roots of the corn and grass.

Again, in the great droughts of 1854 and 1856, many trees died in low places, along branches or runs, where the ground was usually moist, whilst on the top of dry ridges none perished. An examination showed that where these trees died the soil, not over three or four feet in depth, was based on gravel, which rested on a solid rock, cutting off all connexion with a deep subsoil moisture. No rock intervened on the ridges, hence the trees there were preserved, and that too when the heated air did not cool at nights on these ridges as it did in the low valleys. No test perceptible to sight or touch that I made in these years at the dawn of day indicated moisture in the atmosphere.

If I am correct in the opinion that the source of moisture in times of drought is in the subsoil and not in the atmosphere, then the importance of mould as a non-conductor of heat becomes apparent, and we readily perceive why new lands abounding in it are not affected by our usual July and August droughts.

To recapitulate: we thus see that mould possesses three properties essential to the growth of crops, especially that of corn; it gives them by its decay carbonic gas, by its absorbent power it takes carbonic and other fertilizing gases from the atmosphere and yields them to the roots of these crops, and, as a non-conductor of heat, it retains the subsoil moisture around these roots.

The importance of rightly understanding the nature and the action of the mould of the soil is seen in the premium corn crops of the west, where droughts are more prevalent than along the line of our great northern lakes, and in our northeastern States. With the premium crops of Indiana, awarded by its State Board of Agriculture, I am most familiar, and all show that a new, rich moist soil has had far greater agency in the production of those heavy crops than any superiority of cultivation. They exhibit the fact that inferior cultivation with such a soil has made larger crops than excellent cultivation with a fair soil. Hence it follows that the first matter to be considered in the production of a corn crop is the best modes for restoring mould to soils already worn and of preserving it in those which still possess it.

HOW MOULD MAY BEST BE RESTORED TO THE SOIL.

The principal corn-producing States are Ohio, Kentucky, Indiana, Illinois, and Tennessee, and it is for the farmers of these States especially that this article is prepared. I shall not, therefore, consider guano, the phosphates, and mineral manures among available agents for western farmers to increase the fertility of their lands, because the prices of western products will not admit of their use. Thus, for instance, in the experiment of the State farm of Massachusetts, the cost of the manure was forty dollars per acre, producing 89½ bushels of corn. This at the western price of 20 cents per bushel would bring $17 90, an amount not half enough to pay the expense of manuring.

There is but one way that the farmers of these States can enrich their lands in reasonable time: by the rotation of crops, aided by barn-yard manure. Rotation of crops has two objects in view: to rest the soil by following a crop with another which mainly subsists upon different elements, and to increase its carbonaceous matter by such crops as will add largely to it. In the rotation I shall prescribe I will have both these objects in view.

To ascertain the dissimilarity of crops as to their inorganic or ash elements, we must resort to correct analysis, and the following, made by Dr. Salisbury, embrace the most usual farm crops of our country and the principal constituents.

Constituents.	Clover.	Corn.	Corn-stalks.	Rye.	Rye straw.	Oats.	Oat straw.	Wheat.	Wheat straw.
Phosphoric acid	8.80	44.87	17.08	49.55	3.82	43.84	1.54	49.81	3.07
Sulphuric acid	5.98	12.77	1.19	0.98	0.83	10.45	6.46	0.24	5.82
Lime	37.09	1.44	7.98	4.93	9.06	5.95	3.15	2.81	6.70
Magnesia	4.45	16.22	6.64	10.35	2.41	9.95	1.09	13.03	3.82
Potash	26.70	32.48	9.62	20.08	12.36	26.18	3.15	23.72	13.44
Soda	7.07		16.30	11.67	0.31			9.05	0.16
Silica	4.85	1.44	26.97	0.43	64.50	2.67	76.16	1.27	65.38
Chlorine	.....	0.18	3.42	.....	0.46	0.26	0.73	.....	1.09

I have placed these analyses in the order in which the rotation should be made, so that their different quantities might be more readily compared. Clover and corn differ very much; so do corn and rye; so do rye and oats. Between the oat crop and the wheat a clover crop should intervene.

But for the purpose of increasing the mould of the soil the disposal of these crops is far more important than the order of their rotation. This rotation is for worn soils, and if these different crops were harvested they would abstract instead of adding to the carbonaceous matter. The following disposal of them should be made.

The *clover* crop should be pastured but lightly, or by hogs when it is in full bloom, and with such limited number that they would not use the stem or leaves. These should remain on the soil, and with the roots would add largely to the vegetable matter.

The *corn* should be hogged down if possible, but if gathered the stalks and leaves should not be taken off. If hogged down, then all would remain on the field but the grain; the manure of the hogs would represent a considerable portion of it.

The *rye* should be sown among the corn early if it is not hogged down; if it is, not until after that. As a winter crop, the rye will take up much of the gases evolved by the cultivation of the corn crop. It will also prevent the

washing of the loose corn soil, an evil of no small magnitude in the hilly and rolling grounds of the west. This crop should always be hogged down if its full benefits as an improver of the soil are to be realized. My experience is that there is no crop that affords as cheap food for hogs as rye sowed in corn, especially if they are to be sold in September as stock hogs. It makes them weigh well, and puts them in good condition for fattening. The large amount of straw yielded makes it add to the mould more than any other crop.

Oats may follow rye, and this, too, should be hogged down when the restoration of the soil is a leading object.

Clover should be sown on it in the spring when it is sown, for the hogging down will not injure the clover. This clover crop may be pastured the first year and the second until the second crop is coming on, when it should be suffered to mature its seed, that it may seed itself when in wheat, and add by its stem, leaves, and roots to the fertility of the soil, and increase the crop of wheat that is to follow.

The *wheat* may be harvested, and the self-seeded clover allowed to grow for two years, when it should be turned under, as above directed, for the corn crop.

This rotation is given for lands much worn, especially uplands, and with the disposal of the crops recommended I feel certain that the farmers of the west will approve of it.

For alluvial, or other lands not much worn, and where it is desirable to raise more corn, the rotation may be very different. The hogging down of our corn crops on the rich alluvial soils has done much to preserve their fertility, even when they have been annually planted in corn for thirty years. Still, an occasional clover crop turned under without being pastured, and an occasional deep ploughing, would do much towards mitigating the effects of drought on these soils, by adding to and turning up new mould.

On new uplands wheat and clover should alternate with the corn crop, and as much of the corn hogged down as suits the arrangements of the farmer, and, I regret to add, of the distiller.

The proper management of manures.—I have stated that the rotation laid down should be aided by barn-yard manures. Although these manures, of themselves, are no protection against droughts, but when freshly applied to the corn crop increase their effects, yet they add so greatly to the growth of clover and the straw of grain crops that indirectly they largely increase the mould of the soil.

In the west, where sheds and stalls may be constructed cheaply, there is no apology for the farmer who feeds his cattle and horses out of doors. I prefer large stalls, and the animals turned loose in them. I do not remove the manure during the winter, but let it remain in the stalls. My cut up corn finds an appropriate place in a shed 75 feet by 14, which is fed out in large racks. No other foddering substances add so largely to the quantity of the manure, and the trampled stalks absorb by their filth the liquid manure, and keep the stalls clean. The trampling excludes the air from the manure, thus preventing heat and fermentation. If this be accounted a slovenly practice, my apology is its great utility, and the highest of all agricultural authority sustains me in it. Speaking of the method of retaining the manure in the stalls, Thayer says: "The process of decomposition is commenced by the action of the moisture naturally contained in the dung, and as it is then less exposed to the atmospheric air it loses little or nothing by evaporation; it even absorbs the dense vapors which exhale from the cattle and collect near the ground. These facts are indisputable, and the fear entertained by some persons that the vaporous exhalations arising from the dung may be injurious to the animals is quite groundless. There is no offensive smell observable in the stables; the air contained in them is always perfectly free and respirable, provided they are well ventilated. The manure thus obtained, especially that which constitutes the

lower stratum, is of an excellent quality; and by the time it is removed from the cow-house it has passed that stage of fermentation in which it evaporates most quickly, its volatile parts having already entered into combination with the solid matter."

This method is referred to in Alexander Speck's letter to Joseph A. Wright, published in the Patent Office Report for 1859. He says:

"The litter remains in the stable from four to six months at a time, sometimes attaining the height of three to four feet. Every day a little clean straw is laid down, which becomes mixed with the excrement of the sheep, and is compressed by them into one solid mass, forming the floor, which is perfectly dry, healthy, and sweet. The consolidated manure thus formed is not the least of the profits derived from the sheep. No other farm-yard manure is equal to it, and for turnip crops, and especially for rape seed, it is the very best fertilizer, *as not being exposed to the open air, and being well compressed, it retains its ammoniacal properties.*"

I commend to the attention of the reader the italicized part of this quotation, for I have kept manure in this way for a year in the stalls until it was completely rotted, and the sense of smell never indicated the loss of ammonia. One of the last things I should practice in my farming would be the removal of the manure until the fields were ready to receive it.

With such a rotation, and with barn-yard manures carefully preserved to aid the growth of these crops, no danger of an impoverished soil need be apprehended.

The nature of the corn plant.—As correct husbandry must regard the nature of the plant cultivated, the necessity of some remarks on that of the corn plant is obvious.

The analyses of the corn plant in the different stages of its growth furnish one of the best means of determining its character. I am indebted for these also to Dr. Salisbury.

Its general composition at the times when the analyses were made is as follows:

On the 3d of June, 15 days after planting, the *stalk* consisted of—

Water	89.626
Dry matter	10.374

On the 5th of July—

Water	90.518
Dry matter	9.482

On the 26th of July—

Water	82.33
Dry matter	17.66

On July 12th the *root* consisted of—

Water	81.026
Dry matter	18.974

As late as the time of tasselling, the amount of water in the different parts of the plant is as follows:—

In the leaves	86.78
In the sheaths	91.48
In the stalks	95.03
In the husks	89.08

The amount of water in the *grain*, at the times mentioned, is—

August 30	90.80
September 18	78.75
October 1	85.50
October 18	8.45

These analyses teach us a most useful practical lesson. They show that not only during the entire time of the usual cultivation, but even until the first of October, about *nine-tenths* of the plant and grain are water. The roots, therefore, during this time are actively engaged in taking up the moisture from the soil. It is necessary that it should be so, for the life of the plant is short enough to take up in this water, and elaborate in the leaves, the large amount of nutritive matter contained in the grain and in the stalks.

I have not met with any statement showing the amount of its evaporation. There are plants, such as the cactus, designed to endure extreme droughts and yet remain full of sap. The grape vine evaporates not half so much to the square inch of leaf as is evaporated by the apple. But in the absence of such statement we know that the corn plant is not one of them, because of its injury from drought, from the rapid drying up of the stalk and grain between the first and middle of October, when the roots cease to take up moisture, and by the great elaboration of the sap, which can only be done by casting off the surplus water by the leaves. Their pores must be numerous, and these govern its evaporation. If so, then it inevitably follows that the cultivation absolutely essential to it must regard as of the first importance a liberal supply of moisture. The analyses of the grain and stalk, as given in this essay, show the large amount of their fertile elements, and these are gradually introduced into the plant by the abundance of the sap. Hence, when lessened by drought, the grain of the corn is deficient in them, being in a great measure destitute of the oils and very deficient in starch, the grain being what farmers call light and chaffy. This condition of the plant exhibits more fully the absolute importance of the mould of the soil as a non-conductor of heat.

Especially must the plant be supplied with moisture at what is properly termed the critical time of its growth, when it is tasselling and the ear and silk are shooting. The tassels being at the extreme end of the stalk, and all the evaporating surfaces of the leaves being between them and the roots, they are endangered the more, as well as from their unshaded position on the top. The consequence of their drying at this time is fatal, for no matter how large the stalk may be, it will not throw out shoots or silk when the fecundating portions of the plant are destroyed. This critical condition usually occurs during our July drought, and hence the soil should not only have an abundance of mould, but such depth of ploughing and fineness of pulverization as will fit it for the greatest enlargement of the roots and their most vigorous action during this month. Hence, to impair their action by a late ploughing and breaking the roots just before the drought sets in has always been regarded as most unwise.

To more fully exhibit the importance of thorough cultivation, I give the following table of the analyses of the grain at different times of its growth, to show the elements it draws from the stalk, which are mostly prepared and elaborated in it during the months of June, July, and August. The analyses of Dr. Salisbury show a diminution of the fertile elements in the leaves and stalk from the 19th of July; they, therefore, pass into the grain, and a neglect or improper cultivation of the plant affects the grain, no matter how favorable the season may be in August and September—a fact well known to every practical farmer.

The analyses of grain at the different times of its growth are as follows:

	August 30.	September 13.	October 18.
Sugar, an extract	3.67	5.10	13.32
Starch	1.04	9.75	56.30
Fibre	.....	2.43	0.89
Oil	.....	.....	4.60
Gluten	1.42	.....	3.68
Matter from fibre	1.03	1.53	5.99
Albumen	0.21	0.84	4.29
Casein	0.08	0.04	0.08
Dextrine	0.64	0.66	3.26
Water	90.80	78.75	8.45

The analysis of the cob shows that these elements pass from the stalk to it, and from it to the grain. The great increase of sugar and starch in October shows that the development of these substances takes place at a late period. This is especially so with oil, one of its most important components, and that which makes it so useful for fattening purposes. A want of sap checks these important operations, and hence the soil and cultivation must regard not merely the *growth* of the plant, but its subsequent *action* in the formation of a perfect grain.

Here we see how drought acts so injuriously; why, in our deteriorated soils, we have our crops of corn lessened one-third by it, and the absolute necessity of a more perfect cultivation and a speedy restoration of our despoiled lands.

CLIMATE AS AFFECTING THE PHYSICAL CONDITION OF THE SOIL.

We have seen how much the corn crop suffers from the droughts of our climate. Its action on the soil must also be considered, for the cultivation is controlled in a great degree by it.

The climate of the United States is a peculiar one. Most of it lies within the dry belt of the trade-winds, which, in our summers, make the dryness of the California climate and of New Mexico, where the corn crop is dependent on irrigation. There are two of these dry belts, one on each side of the equator, and their dry winds blow diagonally into each other, producing by their mutual action a belt of rain about five hundred miles in width under the equator, and directly under the sun. These winds are concentrated by the lofty range of mountains in South America and Mexico, and turned northwards, carrying with them this belt of rains. In our summer they extend west as far as the middle of Texas; thence north, through the middle of Kansas; they curve gradually eastward and pass to the Atlantic by the line of the great northern lakes, covering all the old States with the rains from this equatorial belt; extending no further west than the middle of Texas and Kansas, they leave the western portions of them to the dry California climate, *thus limiting the corn culture to the already settled portions of our country.*

These rains, from causes not yet ascertained by science, are irregular as to *time*, *quantity*, and *duration*. In the spring they are more concentrated, giving us the heavy, beating rains of March and April, and in July and August they cease almost entirely. We have no rains from the evaporations of our country; these we see in the form of dew only, or, at most, they but slightly increase the amount of our equatorial rains.

From this source of our rains result the extremes so peculiar to the American climate. At one time our ploughed lands are saturated with water, our clay soils are *melted*, and in drying out are compacted, so as to be much harder than the frosts left them in spring, before they were broken up. Then quickly follow droughts, parching and baking the soil, making it unfit, if worn, for profitable production. These influences of the climate so act upon the soil that the standing topics of our agricultural writers are drainage, deep ploughing, and constant stirring of the soil.

To show how injurious these extremes are, and what increased labor they devolve on our farmers, I refer to a portion of my farming experience.

In the latter part of May, 1861, I ploughed three patches for potatoes, containing in all nearly three acres. One was a fertile limestone loam, in part of which the sand predominated over the clay. The others were clay soils—one rolling, having a good soil; the other level, and made rich by stable manure. They had been ploughed in 1860 a foot in depth, and, when ploughed this year, were very mellow and loose. They were planted on Wednesday, Thursday, and Friday, and on Saturday there fell one of our extreme rains, flooding the patches, washing gullies in them, and *melting* the soil, as it were, to the depth they were ploughed. In drying out, all of them settled so compactly that not one-third of the potatoes ever came up, and those that did showed slender and weak vines. They did not yield the amount of seed I planted.

On the other hand, one of the best corn crops I ever raised, estimated to be a hundred bushels to the acre, received no other cultivation after it was planted than one ploughing of a single shovel-plough, run but twice in each row. Seasonable and moderate rains, with uniform heat, characterized the whole season. At other times I have been obliged to loosen the potato soil by running four times in each row with a bull-tongue plough, and with a pick loosening the compacted soil between the plants in the row. Hence, no modes of cultivation, inflexibly to be followed, can be laid down, but the experience and judgment of the farmer must guide his cultivation of the crop. Still, general directions may profitably be laid down, and to this the last part of my subject I now proceed, purposing to consider the kinds of corn, the proper mode of saving seed, implements, breaking up, harrowing, planting, cultivation, and harvesting.

THE DIFFERENT KINDS OF CORN.

These are two—the white and the yellow—distinguished not so much by color as by their uses. The white is preferred for meal when used for human food, for the yellow corn meal always has a raw taste, no matter how long or in what way it is cooked. But the yellow is preferred for stock feeding, because the cob is softer, and it is said the grain has more oil.

The varieties of these kinds are almost innumerable, for the corn mixes more readily than any other grain, and hence we have corn of nearly all colors. The blood-red is flinty, but the cob is very hard, and the calico is a smaller variety, having the same characteristics. But these and other colors, as the blue, do not differ from the white as to the qualities of the meal.

But the most important difference, as connected with cultivation, is in size. These vary from the eight-rowed to the thirty-two-rowed, the last number found only in the horse-tooth variety, having long, slender grains. The eight-rowed belongs to the north, where the summers are shorter, and the largest varieties can be matured only in the south. As a general rule, the lesser the number of rows the more flinty the grain is, and the greater the number the less flinty—a difference that results in forming the dent and gourd-seed varieties. The dent is smooth on the top or dented in; the gourd-seed has a prolonged husk, terminating like a gourd-seed, and hence its name.

In selecting the kind to plant, the farmer must be governed by his latitude

and his soil. The further south the larger should be the size, but in the western States a medium size of the dent variety should be preferred. If the soil is a rich sandy loam, as the alluvial soils of the west, larger kinds may be selected than if the soil is a clay upland, for on such alluvial soils the crop matures from two to three weeks earlier.

As to the yield per acre, the difference is in favor of the smaller and medium varieties; for the smaller the kind, and the further north it is grown, the closer it may be planted, and the greater the number of stalks left in the hill. I have seen farmers from the northern States, who removed to the west, bring with them their eight-rowed yellow kind, and plant it, as they had done in the north, in hills three feet apart, leaving from four to six stalks in the hill. It needed but one season's experience to convince them that no crop could be so raised in the west. In Tennessee and Mississippi the largest varieties are planted from four and a half to five feet apart, with but two stalks in the hill. Small, early kinds, that yield large crops in the extreme eastern States, as the improved King Philip, yield but moderate crops in the west, and quickly run out. Large southern varieties do not mature before frost; hence, in selecting seed it should be taken from the latitude where it is to be planted. Still, we find acclimated early varieties, said to have come from the north and south, which are used mostly to replant. While more attention has been given to the selection of good seed corn than to that of any other cereal, for it is more easily selected, but little care has been bestowed in the production of new varieties by mixing.

In the cultivation of the potato I have found it necessary, to avoid entire failure, to plant at least three kinds—an early, medium, and late kind, and plant at different times. The irregularity of our climate makes our corn crops uncertain, though not to the extent that it acts upon the potato. Still, two kinds of corn should be planted—an earlier and a later variety. And for this purpose crosses of the yellow early eight-rowed and of an early white kind, such as the Red River, ought to be made with later kinds of the same color, and the first ripened ears carefully selected for crop planting.

THE PROPER MANNER OF SAVING SEED.

Although the analysis I have given of the grain of corn shows that it rapidly parts with the largest portion of its water during the first half of October, yet both it and the cob retain enough during November to endanger its future germination if very cold weather happens in this month. In 1859 and 1860 the coldest days of the winter were in November, and three or four years ago it was so intensely cold on the 17th, I believe, as to destroy the vitality of corn in nearly every part of the west. Every farmer knows how vexatious it is to have his corn come up badly, and how much additional labor its replanting has given him.

There is but one way to surely guard against our uncertain climate in this matter, and that is, as soon as the husk on the most forward corn has turned brown and loosened from the end of the ear, to go into the field and select the seed corn for the next planting. Only the earliest and most perfectly ripened should be selected, and such may be known by the flinty appearance of the corn and a perfect development and growth of the grains on the end of the cob. The grain should be well hardened, especially if the kind is a large one with a thick cob, for pulling it when in the dough state will cause the grains to shrivel and the cob to soften and mould. The husk should be stripped back, and by it two ears tied together and hung up in a dry, airy place where it may receive some heat, should severe weather occur before the cob is thoroughly dried out. Thus saved, the farmer will know that his seed corn will certainly germinate. There are few of the smaller matters more important than this, and few that are almost so certain to be neglected. I have lost more time in replanting every

year when I neglected it than would be required to save the seed in this way for ten years.

IMPLEMENTS.

The necessary implements for the cultivation of a corn crop are a large turning plough, a heavy harrow, a small turning plough to lay off with, a light three-shovelled cultivator, a bull-tongue plough, with a shovel to replace the bull-tongue, or a two-shovel plough.

There are but few agricultural implements which have received greater attention than the large turning plough, perhaps none. Scientific skill and practical trials have combined their efforts to perfect it, and yet much remains to be done in that which most concerns the corn crop, namely: the turning under of a full growth of clover, or the straw left on the field by hogging down rye or oats, or a heavy growth of ragweed. Ploughs to turn over a loose soil or a smooth sod are readily had, but not the other. The difficulty lies in combining deep ploughing with perfect turning under, lightness of draught, and freedom from choking. How far the beam may be advantageously raised, and what combinations of the lifting and turning forces of the mould-board may be formed to do such ploughing successfully, have not yet been demonstrated. But much has been done in this direction, especially by the leading plough-makers of Indiana. To carry out the rotation and use of the crops I have recommended, the best plough for these combined purposes should be procured. A choking plough is such a provocation that when soils were less worn it was not surprising that good farmers habitually burnt off the "trash" before they commenced ploughing. Where weeds, grass, or straw are to be turned under, especially if fast to the soil by the roots, a log chain fastened to the beam, so as to drag down these before the mould-board, very much facilitates their turning under. If a heavy sod is to be ploughed up, such as is usually found in blue grass pastures, double ploughing should be practiced, or a double team in the Michigan plough. The object is to turn the sod so deeply that the subsequent cultivation will not disturb it.

Of the harrow I need not speak; its common use in pulverizing the soil and levelling it are known to all. To be an efficient pulverizer it must be heavy, and on hard or sod lands should be used until its purpose is accomplished. Where sod is turned under with a single plough it should be cut up a good deal, and for this purpose there are harrows with cutting edges, somewhat resembling the short, strong teeth of some cultivators.

If the soil is mellow and free from grass, straw, weeds, or sod, the shovel-plough will do to lay off with, but if either of these is in the soil it is too easily turned aside to be used. A small turning plough is much better in such a case.

In the first cultivation of the corn crop it is usual to use the harrow, or a light cultivator, with three small shovels. Such a cultivator is easily handled, and may be run very close to the corn without danger of injuring it or covering it up. The soil then need not be deeply stirred, unless, as is often the case, heavy rains have fallen and compacted the soil, as heretofore mentioned. In such cases the best implement to break it up deeply, and at the same time close to the plants, is the bull-tongue. In clay lands its use cannot be dispensed with. A light subsoil plough would be as efficient, but as shovels of different sizes can be used on the same plough to which the bull-tongue is attached, it makes a light, cheap, and useful implement, adapted to most of the purposes of tillage.

In the third and fourth ploughings the larger and heavier two-shovelled plough is a speedy implement, for it loosens up the middles with twice running between the rows. It saves, therefore, a third of the time, for a single-shovelled plough must be run three times in these ploughings.

In the cultivation of this crop, the farmer, like the mechanic who has a variety

of the best tools, will find his interests consulted by having every implement that can best perform the work for which it is used. An implement that is used for a great many purposes is like the man who is "jack of all trades"—he is master of none.

BREAKING UP.

This is by far the most important operation connected with the tillage of corn. I shall consider the times and modes by which it can best be performed.

1. *The times.*—Ploughing for the corn crop may be done in the fall, in the winter, or in the months of March and April. Much diversity of opinion exists as to which is the best. If green crops are turned under early in the fall, high chemical authority alleges that the rapidity of their decay evolves acids, which are injurious to vegetation. Besides, the soil by winter and early spring rains will be so much settled as to require a second breaking up before planting, or at the first ploughing of the plant.

If much ploughing is to be done, a portion of it may properly be performed late in the fall or in the winter, for the facilitating of the operations of the farm will compensate for the deeper ploughing that may become necessary in the first cultivation of the plant.

But we have seen that a critical time of the corn crop is at its tasselling, and early spring ploughing brings at that time the decay of the grasses or straw which may have been turned under. If ploughed in the fall or winter, the early deep cultivation of the plant will bring the decayed grasses too much to the surface. On the other hand, if the farmer desires to deepen his soil, fall or winter ploughing is advantageous by exposing his under soil to the ameliorating action of the cold. The better course is to plough in the fall and winter all lands to be deepened, leaving those deep enough to be ploughed in the spring.

2. *The modes of breaking up.*—These are by shallow, deep, double ploughing, and subsoil ploughing. In the west four inches and under are regarded as shallow ploughing, and from eight to twelve inches deep ploughing. But properly these terms relate more to the natural depth of the soil than to inches. If ten inches in depth upturns much of a clay subsoil, it is too deep for a rich, well-pulverized soil, though but six inches deep is better than the same amount of fertility mixed with four inches of unameliorated clay subsoil. Fall ploughing is useful in such cases, but even then the depth should be increased gradually. Double ploughing is usually performed by one turning plough following another in the same furrow. This is useful in turning thick sods under deeply, such as are found in old blue grass pastures. It buries the sod so deeply that the subsequent cultivation does not disturb it until well rotted. This ploughing may also be done by a double team with the Michigan plough.

Subsoil ploughing does not turn up or mix the under soil with the top soil, but simply breaks it up finely so that the air and surplus wet may pass through it. Whatever the modes of ploughing may be, they have a common object in view—the pulverization of the soil so as to allow the air and water to pass through it. Whilst I have not claimed for deep ploughing its alleged effect to prevent the action of drought, yet as an enricher of the soil and as an active agent in advancing the growth of the corn and other crops, especially those requiring clean culture, it merits all that has been claimed for it.

In the Ohio Agricultural Reports for 1859 there are experiments given exhibiting the agency of air and of carbonic gas in the growth of crops, which I here lay before the reader to more lastingly impress upon his mind the absolute necessity of having a deep, loose, and well-stirred soil. Nothing is more common in the west than to hear farmers speak of good crops raised by shallow ploughing. I grant this has been done, but when? When the soil was new, full of mould and decaying roots, which of themselves made a deep soil, allow-

ing the roots of the corn to penetrate more deeply than the plough had done. But now the case is very different. Our soils have no such loosening agents. Even our new lands are different from what they were twenty years ago. Then no stock ranged over them, and the mould from leaves and an undergrowth of weeds and vines was shoe-deep. Now the mould is much less, for no weeds and wild flowers grow on them, and the soil has been trampled by the stock. This past experience, therefore, furnishes an unsafe guide for the present.

These experiments were made with three glass vessels, in depth two and a half feet, which were filled with soil of a like character, and planted in oats and peas. They grew 110 days, and then the plants, with their roots, were taken out and dried, and their ashes analyzed, and the soluble mineral substances ascertained that were left in the soil. In one of these vessels no air was introduced; in another, it was by a hole in the bottom of the vessel; and in the third one, air and carbonic gas by the same means. The result is as follows, the estimates being made for the acre:

I. *Experiment without additional supply of air.*

Quantity of dry plants, in pounds, per acre:	
Oat plants	1,560
Pea plants	688
Roots of both	108
	2,356
Soluble mineral substances, in pounds, per acre:	
In the ashes of the plants	208
Left in the soil	608
	816

II. *Experiment with supply of air.*

Quantity of dry plants, in pounds, per acre:	
Oat plants	3,060
Pea plants	984
Roots of both	152
	4,196
Soluble mineral substances, in pounds, per acre:	
In the ashes of the plants	380
Left in the soil	1,104
	1,484

III. *Experiment with supply of air and carbonic gas.*

Quantity of dry plants, in pounds, per acre:	
Oat plants	3,396
Pea plants	1,304
Roots of both	240
	4,940

Soluble mineral substances, in pounds, per acre:	
In ashes of plants	448
Left in the soil	1,548
	1,996

These experiments exhibit the important action of air and carbonic gas in the growth of vegetable matter. The first increased the plants in size about eighty per cent.; the mineral substances in the plants about eighty per cent.; and the soluble minerals left in the soil about eighty per cent. The carbonic gas increased the growth of plants over that caused by air alone about thirty per cent.; the mineral substances absorbed by the plant thirty-five per cent.; and the soluble minerals left in the soil seventy-five per cent.

The element of the air which causes such important action is its oxygen. It is the great destroyer either by rapid burning or by slow decay. It is this which, uniting with the wood of plants, turns it into carbonic gas. It aids in rendering soluble the insoluble minerals of the soil; that is, it so changes them that they dissolve in water and are carried by it into the roots of the plants. Hence it is the great destroyer of the mould of the soil, as I before have stated, turning it into carbonic gas, and thus making it useful to form new vegetable growths. By returning these to the soil we increase the amount of the mould, for in addition to the amount of carbonic gas they have derived from the old mould they have received much from the atmosphere.

The deeper, then, the soil is ploughed, the more of its particles the air reaches and turns their mould to carbonic gas, and the greater amount of its mineral elements are rendered soluble. Hence it is necessary to keep this soil well stirred, because our rains compact it, and to bring the oxygen in contact with every portion of the particles of mould, just as you would stir a glass of water having sugar or salt in it, which you wished to have dissolved.

Ploughing, then, being the medium by which this action of the air and its carbonic gas upon the growth of plants is facilitated, is of the utmost importance to the farmer. Mr. Rabb, of Rising Sun, Indiana, has been justly called its model farmer, and his mode of ploughing so well unites the various advantages of common and subsoil ploughing that I allude to it, premising this, however, that one of his farming maxims is this: "To raise with clover, and manure all lands to bear good crops before he sows or plants in grain." Having provided mould and fertile elements, he thus establishes the connexion between them and the air.

After breaking up deeply in March, he lays off the field for planting by running four furrows with a turning plough, two on each side of the drill in which he plants his corn. These drills are about three feet three inches apart, and the subsoil plough is then run about three times in them. He never allows weeds to grow in the corn, but continues ploughing, in dry weather and in the fall, until weeds and grass cease to grow. By these methods he says he has raised, for the last ten years, over one hundred bushels of corn to the acre. This mode of breaking up, and the culture it leads to, cost about one third more than the usual breaking up and cultivation, but the yield is double in quantity. But this method of breaking is well adapted to wet lands by draining the water below the roots of the corn in the subsoiled furrows It may be advantageously practiced in heavy clay soils usually found along creeks where the lands recede towards the hills and do not readily drain their surplus water into the creeks. Instead, however, of planting in the low subsoiled furrow, a drill should be run on the ridge, and the corn planted in it, leaving the low and subsoiled portions to carry off the water.

HARROWING.

But little need be said of harrowing. Its object is to level and pulverize the soil. For these purposes the harrow should be heavy, and used until its work is completely performed. I use a heavy double V, and always reach over half the width of the preceding round, equal to twice harrowing. Sod ground ploughed in the usual way should be harrowed both ways in this manner, for all subsequent cultivation, as well as the prevention of the growing of the grass and the hastening of its decay, depend upon the harrowing being thoroughly done. If the harrow is not heavy enough, it should be made so by a stick of wood tied across it. In ploughing clay soils, it is better to use the harrow every other day at least, especially in drying weather; for if left until the whole field is ploughed, as is usual, the clay is apt to bake, making it difficult to pulverize.

LAYING OFF.

This is always done immediately before planting, in order that the places to plant the corn may more readily be seen, and that the soil for covering the grains may be as light and loose as possible. A shovel-plough is generally used if the ground is free from sod, grass, or weeds; but if not, the small turning plough is better, for it is not so easily turned aside.

The distance apart of the furrows should be determined by latitude, kind of corn, the richness of the ground, and the probabilities of the season. As already noticed, the small corn of the north may be planted three feet apart as a general rule, but in the south not less than four and a half feet. In the western States the usual distance on uplands is four feet, and on alluvial soils about three and a half feet. These are the distances for hill planting where the field is laid off both ways. But if the corn is small for the latitude, the planting may be closer, as three and a half feet for the rows running north and south, and three feet for those running east and west. Three feet by two and a half, leaving but two stalks in the hill, may do very well, in excellent soil, for such corn as the calico, which is rather under size for the latitude of the west. But larger varieties must have more space, especially if the probabilities of the season indicate drought. Since 1854 the crops of corn in the west have been much heavier every alternate year, these years being the odd numbers, as 1855, 1857, &c. How long this will continue no one knows. The record of the weather in New England, from 1623 to the present time, shows that our climate is liable to intense drought, occurring at irregular intervals. The first half of the present century seems, in a great measure, to have escaped them, but since 1850 these droughts appear to be returning. Hence in laying off, the locality, as well as the mould of the soil, must govern the farmer when he aims at raising the heaviest crop. A low, moist location on a river bottom is much more favorable for such a crop than soil equally as good that lies higher and not in the vicinity of a river, for its fogs aid the corn crop no little. These circumstances are frequently overlooked, and an entire failure of the crop is often the consequence.

In *drill* planting the ground is laid off in one way only—usually in rows running north and south. The width of these varies from three to five feet, according to the richness and moisture of the soil, and the distance apart of the stalks in the rows, which must be governed by the kind of corn. Thus, for instance, the premium corn crop of the State fair of Indiana in 1860 was 263 bushels to the acre, *weighed* between the 5th and 10th days of October, when one-third of the weight probably was water. Still the crop was enormous. The kind of corn was the calico already noticed, the drills three feet apart, and the plants from five to six inches apart in the row. This was a river-bottom crop, having all requisites that are demanded for such a mode of planting.

I have spoken of Mr. Rabb's mode of planting by drills, which are subsoiled three feet three inches apart, and the plants twelve inches apart in the row, leaving very often two stalks together. His crop, as entered at the same fair, was 132½ bushels to the acre. Drill planting requires more cultivation with the hoe, but the greater yield amply compensates this kind of labor.

PLANTING.

Before planting, the corn is sometimes soaked, then tarred and limed, or covered with a mixture of lime, ashes, salt, and gypsum. This is done with a view of aiding the growth of the plant whilst young, but particularly to protect it against the depredations of birds, moles, and the cut-worm. From my experience I do not think any advantages are gained by so doing. I concur with Mr. Coffin, of Dutchess county, New York, who says: "After trying various methods of preparing seed by soaking and rolling it in different substances, I have abandoned the whole, and plant as it comes from the cob."

Many implements have been invented to facilitate the planting and covering, but none have been successfully introduced. This arises from the fact that both these operations may be well done by the younger and female portions of the family, and the covering made with the most pulverized soil by the hoe.

In planting, many farmers so dread thinning out that no more grains are dropped in the hill than they desire to grow. This is wrong. Even when the seed is properly saved they generally have to replant or cultivate a crop so thin on the ground as to be unprofitable. At least two grains more than the required number of stalks should be planted, for, besides the defect of the seed in the ordinary way of saving it, the weather often suddenly becomes cold and wet, with beating rains and drying winds, during which the seed is liable to rot, especially those of weak vitality, or are prevented by small clods from coming up, and when they are up they are thinned out by birds and the cut-worm. It is much better, then, to thin out than to replant; it is more speedily done, it allows a selection of the most thrifty stalks, and replants are always dwarfed either by the late planting or by the injury received from having an older stalk in the hill.

The *covering* should be as light as possible, more especially on clay soils, and all clods should be carefully removed. Farmers are often successful in deep covering, but only so when favored by a rich, loose soil and the absence of beating rains. The sooner the corn is up the better, and to avoid too deep planting the furrows should not be deep.

CULTIVATION.

After the seed is planted it is not usually necessary to commence the tillage until the plants are up. But sometimes it may be advantageous to do so. Thus in level clay lands which have no surface drainage, which have an impervious clay subsoil, or which are undrained and unsubsoiled, it may be well, in wet seasons, to run a deep furrow in the middle of the spaces between the rows as soon as the corn is planted. It will aid the drainage and draw much of the water from the more shallow furrow in which the corn is planted.

At other times a compacting rain falls immediately after the corn is planted, and usually followed by dry, cold winds, which bake the surface so compacted. Under these conditions the corn shoots cannot break through this hard surface, especially if the seed has been deeply planted. A light harrow should then go over the field that this crust may be pulverized.

When the corn is up the culture should commence with a light three-shovelled cultivator. I prefer it to the heavy two-shovelled, because it can be run within an inch of the plants, thus loosening the soil immediately about them, and

throwing some loose soil in the hill to destroy grass and weeds that may be growing in it. The shovel next to the hill should not be run as deeply as the other two. This "going over" should be by the most steady plough-horse the farmer has, and requires constant watchfulness on the part of the ploughman, especially if the laying off and dropping has not been well done, for the cultivator should always be close to the hill, and not six or ten inches from it, as is too often the case.

The second ploughing should be done in the same manner. These leave the ground level, the surface stirred and clean of weeds and grass. But another object of the cultivation is to loosen the soil that the air may readily penetrate it to the depth it was broken up, so that it may carry its carbonic acid to the roots of the plants, and penetrate the soil in all directions, that its mould may absorb this carbonic acid and be decomposed by the oxygen of the atmosphere, and the insoluble minerals rendered soluble. The third ploughing must have these objects in view as well as the destruction of the surface weeds and grasses. To accomplish them the soil must be completely stirred to the depth it was first ploughed, and this should be done by the double-shovelled cultivator or the single-shovelled, or the bull-tongue.

If no compacting rains have fallen, the double shovel is preferable because it is more speedy than the single shovel. It requires but twice running to the row, but the single shovel three times. But often, particularly in clay soils, the ground is so compacted by what may properly be called *melting* rains, that it is harder than before it was broken up. In such cases the best implement is the bull-tongue, and it should be used until the ground is once more completely pulverized. This may require four runnings to the row, for it is narrow, but on that account leaves no unbroken soil in the bottom of the ploughed ground, as the shovels would do. Such cultivation may be tedious, but it must be done, and the additional labor is to be charged to our climate. If this work is well done, it renders the subsequent cultivation the easier.

The fourth and last ploughing should have an additional object in view, namely, the leaving of the ground in as level a condition as possible, that its washing may be prevented, and, if laid down in wheat or rye, that the seed may have a level surface to be sown on. If there are weeds or grass in the hills these should be covered up, and this may require a small turning plough, or the shovel may be sufficient. If the latter, a double shovel may be used, and the ground levelled with the light cultivator. If a turning plough is required, then the middles should be levelled down with the same cultivator.

It is hardly necessary, at this day, to consider the propriety of level culture as opposed to hilling. Having tried both, I would not tolerate hilling unless in such extraordinary droughts as those of 1854 and 1856, when the roots of the corn did not extend to the middle of the space between the rows. To heap over these roots the soil of the middles in order to protect the subsoil moisture I then found expedient, but as soon as the drought was over or the corn matured I would level the ground. No one who values his soil, or, in ordinary seasons, who regards the value of roots to the corn, would allow them to be washed naked by the streams which hilling causes. Nor does such hilling avail anything in preventing the corn from being blown down. The best safeguard against it is well-developed roots in a deep, level soil, and in such a soil the stay-roots are always most vigorous.

In prairie cultivation the two-horse double cultivator is generally used because it is more expeditious, requiring but one running through to each row. The soil there is light, and no obstructions exist to prevent its use.

The great error of our agriculture is too much breaking up, and, as a consequence, too little cultivation. This error is often aggravated by unfavorable weather in May and June, when, in consequence of continued wet, the growth of the weeds and grass surpasses that of the corn. The practical question, then,

is, shall the cultivation progress during the wet state of the ground, or shall the farmer wait? To stir the ground when it is too wet is always bad policy, and no farmer should put in crops so disproportioned to his labor that he cannot wait until the ground has sufficiently dried. But when he sees that the weeds and grass will seriously injure his crop, he should then risk all consequences from stirring the soil when too wet. If the rains continue, the injury to the ground or the weeds will not be so great, and should they cease, he should then wait until the ground is dryer. After that not a moment is to be lost until every weed is destroyed and the matted fox tail completely annihilated.

The directions I have given for the cultivation of the corn crop contemplate four ploughings. Whether more should be given depends on the season, the soil, and the manner in which the ground was broken up. Mr. Rabb, as already stated, continues ploughing as long as weeds or grass grow. The entries for premium corn crops at the Indiana State fair referred to, show that the crops were cultivated from two to seven times. Thus the one-acre crop of 263 bushels was ploughed with a shovel-plough *three* times. The ten-acre crop of 263 bushels per acre was ploughed *four* times with a shovel-plough and hoed over after the first ploughing. Another crop of 115 bushels per acre was first harrowed with a one-horse harrow twice in the row, and then ploughed over once every week for six weeks, making *seven* cultivations. A crop of ten acres, yielding 172 bushels per acre, received *six* cultivations. A five-acre crop of 180¼ bushels to the acre was ploughed *twice* only with a shovel-plough running but *twice* in the row.

As these crops are reported to the State Board of Agriculture, they set at defiance all modes of cultivation. As in theatres, the reality is not before the curtain, but behind the scenery; so with these reports, behind them the truth is seen. The last-named crop was planted on a piece of ground never before ploughed, which had been a stable lot for many years, where the manure had collected "until the stables had to be removed." It was in blue grass, also, and thus to great natural fertility were added the sod and these accumulated manures. The ground was broken up only four inches deep; had it been ten, and the cultivation more thorough, the yield would have been much greater. Again: the best cultivated field was that which yielded 172 bushels. It was underdrained, broken up from nine to ten inches deep, cultivated seven times, *but planted in hills four feet apart.* Had it been planted in drills, as nearly all the other crops were, it would, probably, have yielded the largest crop.

But again: in the instance given from my own experience of raising about one hundred bushels to the acre, with but one surface ploughing, the crop was thus large, not because it received no better cultivation, but for the reasons that it was sod ground, not very good, however heavily manured with the richest horse manure, deeply ploughed and subsoiled, and planted in drills three feet apart, followed by one of the most favorable seasons I have ever seen. No cold, heavy, compacting rains fell, but warm, genial, and timely showers. All seeds of weeds and grasses had been turned under too deeply to vegetate, and hence the soil remained clean and loose. At another time I raised a good crop without any tillage, the ground being double ploughed and subsoiled to the depth of 18 inches. The season was favorable. But in both these cases the yield would have been much larger if proper cultivation had been given.

When the cultivation may cease must be determined by the season and the condition of the crop. Mr. Rabb's rule is a good one, that the cultivation should continue as long as weeds and grass grow. The analyses of the grain which I have given show that it is not until the first of October that the corn plant ceases to require large quantities of sap; hence weeds and grass or an unfavorable condition of the soil should not be permitted to limit this supply. The grain is long maturing, and it is not until October that it receives the principal amount of its nutritive properties. From the middle of September to the middle of October

the portion of water decreases from 78.75 to 8.45. It is obvious, therefore, that cultivation should not be discontinued so soon as it usually is. But in any cultivation that may be given in the months of July or August great care should be taken not to cut the roots, for they are then not growing vigorously, but are drawing the water with the fertile elements of the soil into the circulation of the plant, that the grain may be perfected.

No cultivation, however excellent, can create fertility; its only object is to establish a more perfect connexion between the soil, the atmosphere, and the roots of the plant. Hence, if the soil is destitute of fertile elements, the best cultivation will be fruitless.

CUT-WORMS, MOLES, THINNING OUT.

About the time the cultivation should commence, and until the second one is completed, the young plants are frequently injured or destroyed by cut-worms and moles. No steeps for the seed seem to deter the cut-worms, and the only available remedy is to search them out. This can be pretty readily done, as they usually go into the ground by the stalk they have cut off, or under some loose clods near by. If diligent search is made for them, it is a much more expeditious mode of destroying them than those who have not tried it would suppose.

Moles are not easily caught, and do much more damage, for their depredations are much more extensive. They harbor under stumps, and, to lessen their number, these should be extracted as soon as possible. Rapid cultivation, which destroys their burrows, is the most effectual remedy that can be prescribed.

When the plants are six to ten inches high the thinning should be attended to. This should be done carefully; the weakest plants should be pulled up, and every hill carefully examined, that no more than the proper number be left. What that number is depends on latitude, size of corn, the distance apart of the hills or the drills, and the strength of the soil. In the north, where the eight-rowed corn is planted, from four to six stalks may be grown, but in the west never more than three, no matter what is the distance of the hills. When the hills are three by two and a half feet but two stalks should be grown, and this number should not be greater on our *common uplands*, even when the hills are from three to three and a half feet apart. If, however, the corn is under medium size three stalks may be left. In the south two stalks only are allowed to stand.

In drill planting greater care must be given to the thinning, lest the crop be injured. The number of stalks to the acre, when the hills are three feet apart and three stalks to the hill, is 14,520. Mr. Rabb thins out to 19,600 in his drill cultivation. Mr. Lake, who raised the 263 bushels of corn to the acre, had his drills three feet apart and the plants from five to six inches apart in the drill, making over 30,000 to the acre. But his land was very rich, moist, and the corn under a medium size.

HARVESTING.

The corn crop is harvested by three modes—by hogging down, by cutting up, and by gathering the ear alone. The old mode of the middle States, by topping, may be regarded as antiquated, as may also the southern one of pulling the blades.

A vast portion of the corn crop is consumed by turning hogs upon it as soon as the grain begins to harden, or about the middle of September. It keeps the stalks, leaves, shucks, and cobs on the ground, together with the rich manure of the hogs. Nothing but the increased fat on them is taken away. This mode has sustained the soil in producing the great crops of alluvial lands as much as their occasional overflowing. It was the expense of gathering and feed-

ing out, matters of no little importance where labor is scarce and its wages high.

A second mode is by cutting up. This is a common practice on uplands of the west, and especially where a good many cattle are raised. Corn fodder is preferred by many to timothy hay, for, although not so nutritious, it is loosening, whilst that hay is binding. To feed both daily is best, and this is my general practice. The following analyses of timothy and corn-stalks exhibit the difference of their constituents, and show how each make up the deficiencies of the other:

	Timothy hay.	Corn stalks.
Silica	31.08	12.85
Lime	14.94	2.82
Magnesia	5.30	0.93
Potash	24.25	16.21
Soda	.....	24.69
Chlorine	4.00	10.95
Sulphuric acid	4.46	10.79
Phosphoric acid	11.29	15.15

Timothy hay is superior in the first four of these elements, but corn-stalks in the last four. The phosphate of lime, formed by the union of phosphoric acid and lime, constitutes the principal part of the bones of animals. Corn-stalks are deficient in lime, but have much of phosphoric acid, and united they form a desirable compound in feeding.

I have given these analyses more particularly for the purpose of showing how unfounded are the prejudices of many farmers against corn fodder, who regard it as being deficient in nutritious elements. These prejudices often arise from improper harvesting, by which it is either wasted or moulded.

The time of cutting up is important, and is always designated by the ear. When the shuck on it has turned brown, and is loose and open on the end of it, then is the *only* proper time to cut up corn. Nature then indicates that the ear is perfectly matured, and that the whole plant is prepared to dry speedily. But many farmers, instead of looking to the condition of the plant, consult their leisure time, or their desire to put a crop of wheat on the ground, or rely on the weather to dry up the blades and stalks, and so commence cutting too soon The shuck being very tight, the grain cannot dry sufficiently to prevent moulding, and not unfrequently, especially in damp weather, the blades and stalks also mould. In irregular seasons the corn ripens very irregularly, and then it should not be cut up until most of the latest ripening are in the condition I have mentioned. At that time the most forward stalks will be entirely dried up, but they still make excellent fodder.

The best *mode* of cutting is with a heavy corn-knife, and striking with the point down—by an understroke, as it is called. If the knife is raised and the stroke downward, the weight of the knife tires the muscles of the arm and shoulder, and weakens the wrist. The point of the knife, too, is always entering the ground and is soon dulled. But in the understroke the knife is turned upwards as it passes through the hill, and escapes the ground. But its greatest advantage is in the fact that the knife is swung, but not raised, thus enabling the cutter to use a heavier knife.

Two rows are cut at the same time, and six hills are thrown together, for, when carried to be set up, two of these bunches usually make a sufficient armful.

The best and most expeditious mode of setting up the shocks is the following: A shock should contain twelve to sixteen hills square, according to the size of the corn. The stalks of four hills, in the centre of this number of hills, should be bent and lapped together. The two rows in which these four hills are should be cut down, and set up in each of the four divisions made by the bending of the four centre hills. These stalks should then be well tied together with the inner bark of the lind or basswood tree. The rest of the hills may then be cut down and set up around these. They should be set up as straight as they will conveniently stand, and immediately tied with a band of the same bark, or of the grape vine, or of broom corn. In about ten days, when the stalks are seasoned and shrunk, these bands should be tightened; if not, the stalks are liable to slip around each other and fall down into a corkscrew twist, when the fodder is easily and rapidly spoiled. But if properly set up and tied they will remain uninjured during the winter.

The time when corn is cut up is one of comparative leisure, and in no other way can so much feed be saved in the same length of time. But when farmers sell the corn, they gather the ears from the stalks in wagons, usually husking it in the field. It is then cribbed, generally in covered rail pens, where it is kept until sold. But to retain the sweet taste and fine flavor of corn for bread or mush, it should be gathered with the husk on, and not husked until used. This mode keeps it from the air and, what is much worse than air, the rats and mice, which not only waste much of it, but give an unpleasant flavor to the corn when ground into meal.

An evil of no little magnitude follows this mode of harvesting. In order to get some benefit from the stalks besides their return to the soil, cattle and horses are turned on the field to eat them. If this were done when the ground is hard frozen it would not be objectionable, but when once in, they are suffered to have access to the field until spring, when the soil is trampled into clods that cannot be pulverized until frozen in the ensuing winter. The loss is tenfold greater than the expense of cutting up and hauling the fodder.

CONCLUSION.

These remarks on Indian corn have been extended further than I anticipated. But for this I have no other excuse to offer than the reader will find in the following anecdote of that eminent teacher, Dr. Wylie, a president of Indiana university:

When he came to Indiana, in 1829, the common schools of that State had made such progress that to be able to teach English grammar was regarded an ambition worthy of every aspiring young man. One of these, the son of a farmer, came to him and desired to be taught English grammar, *and nothing else.* "I can teach you English grammar, said the president." The young man then expressed the wish that his charge would be moderate, as his means were very limited. "Give yourself no trouble about that, was the reply; all I ask is a well fatted hind quarter of beef, with one condition, that you fatten the quarter you bring me, and no other part of the animal." After looking his astonishment, the young man said, "Why, doctor, it is an impossibility for me to fatten one quarter without fattening the whole beef." "Just so it is with me, said the president, I cannot teach you English grammar without instructing you in many other things."

Of what practical utility would it be to give directions concerning the cultivation of Indian corn, and have left unconsidered the soil, the climate, and the plant? It would have been an attempt to fatten but one of the quarters of the beef.

HOP CULTURE.

BY L. T. MARSHALL, VERNON CENTRE, ONEIDA COUNTY, NEW YORK.

THE hop is a plant indigenous both in Europe and America, and said to be found growing in a wild state in sections of European countries, and also along the borders of the Mississippi and Missouri rivers.

It has long been cultivated in Germany, where its use is traced back as far as the ninth century. In other countries it has become an important agricultural product, and in sections of the United States it has become equally so, not only supplying the home demand, but large quantities are annually exported to England and other European countries. The English, who carried its culture to the greatest perfection, are supposed to have first engaged in it in the reign of Henry VIII, about the year 1524, having learned from people of Artois its qualities of preserving beer and ales from fermentation, and imparting an agreeable, bitter flavor to the liquor. The use of ales and porter by the people of Great Britain and on the continent has increased the culture of hops in those countries to an almost fabulous extent.

The following table comprises the statistics of hop culture in Great Britain for five years, and also the amount of revenue derived from it, the duty being two pence per pound, and also five per cent. *ad valorem* additional.

Years.	Acres under cultivation.	Lbs. of hops charged with duty.	Amount of duty.
1853	49, 367	31, 751, 693	£277, 824
1854	53, 823	9, 877, 126	86, 422
1855	57, 757	83, 221, 304	728, 183
1856	54, 527	55, 868, 624	488, 850
1857	50, 975	19, 671, 056	417, 526

The following tables show the great increase in culture in the United States since the year 1850.

The production of hops in 1850, from the census returns, was as follows:

	Pounds.
New York	2, 536, 299
Vermont	288, 023
New Hampshire	257, 174
Massachusetts	121, 595
Indiana	92, 796
Ohio	63, 731
Maine	40, 120
Pennsylvania	22, 088
Other States	75, 024
Total	3, 496, 850

The following are the returns from the census of 1860, (which is the crop of 1859,) as far as the returns of the eighth census have been collated by the Census bureau at this writing:

	Pounds.
Maine	102, 987
New Hampshire	130, 428
Vermont	627, 680
Massachusetts	111, 301
Rhode Island	50
Connecticut	959
New York	9, 654, 154
Pennsylvania	39, 074
New Jersey	3, 722
Ohio, Indiana, Michigan	No returns.
	10, 670, 355

I am indebted to David M. Stone, esq., commercial editor of the New York Journal of Commerce, for the following table of exports of hops for the following years.

Exports of hops from the United States to foreign ports for the fiscal years ending June 30.

Years.	Pounds.	Value.
1854	260, 026	$63, 763
1855	4, 021, 816	1, 310, 720
1856	1, 048, 515	146, 966
1857	924, 538	84, 852
1858	458, 889	41, 704
1859	587, 953	53, 016
1860	273, 257	32, 866
1861 estimated	8, 000, 000	2, 500, 000

The returns for the year ending June 30, 1860, are not all in, but 39,958 bales were shipped from this port (New York) in that time. Nothing fluctuates more than the shipment of hops, as we export largely only when the foreign crop is cut off or seriously injured.

THE HOP DUTY.

The English duty, as estimated by the commissioners of inland revenue, in its rise and fall indicates, in comparison with the *barometer*, not only the quantity grown, but goes far to establish prices throughout the world. The marked fluctuations in the annual product of England will readily be discovered in comparing the tables on a preceding page, and also the following in relation to duty paid by the planters.

The following is taken from the fifth report of commissioners of inland revenue, just published:

"In 1859 45,565 acres of hops were under cultivation, and in 1860 46,272

acres; in 1859 68,496,958 pounds of hops were charged with duty, and in 1860 11,162,777 pounds; in 1859 the amount of duty was £599,346, and in 1860 £69,767. These figures speak for themselves, the duty on hops representing simply the quantity grown. The rate of duty was reduced in the last session from 2*d.* per pound and five per cent. to 1½*d.* per pound. The time of payment, which was formerly May for the first moiety and November for the second, was fixed for March in 1861, and January in all succeeding years; but the postponed payment of the second moiety of the duty on the growth of 1859 has greatly interfered with this arrangement, and such strong representations were made of the impossibility of collecting the large sums due for the abundant produce of a former year, at the same time with the new duty, that the payment of the latter has been deferred to August, on condition of security being given, with interest at five per cent. This stipulation appears to have had the desired effect, as upwards of two-thirds of the duty has been already paid. The second moiety for 1859 has been nearly all paid. We have consented to take bonds with two securities for the future liquidation of the crown's claim in those cases in which we should probably fail in obtaining our due, while we should certainly ruin the planter."

NEW HOPS

The following commercial report exhibits English prices subsequent to a short crop, and also the avidity with which early good samples are taken by the hop merchant and brewer at most enormous prices:

"The first pocket of the growth of 1861 arrived in London on Tuesday, August 16, the growth of John M. Hooker, esq., Moatlands, Brenchley, and was sold by Messrs. Gobel, Austen & Gobel, hop factors, Borough, at £25 per hundred-weight, to Messrs. Ranger & Co., hop merchants, 3 Crown square, and was forthwith again sold by that firm to Evan Evans, esq., the spirited proprietor of the extensive brewery in the Vale of Neath, Glamorganshire. The plant from which this pocket was picked is of the same sort as has furnished the earliest hops for some years past, and known as 'The Brenchley Prolific.' The quality for so early in the season is unusually good, and justifies the anticipation of some very early samples of this year's growth."

The great influx of foreigners to this country, and their accustomed use of the various kinds of ales and porter, has greatly increased the demand for hops both in the United States and Canada, and they are being grown with greatly increased care and skill as compared with the cultivation of former years, not only in the culture but in the kiln-drying process. Although the routine of culture has been heretofore published in preceding volumes of the Patent Office Report by both European and American hop-growers, I shall only treat generally, rather than by minute details, of

CULTIVATION.

The successful cultivation of the hop implies most watchful and incessant care during the first stages of its growth. It should be planted upon a warm, deep, loamy soil on a dry bottom, which is best found upon a sandy, gravelly, or stony, porous subsoil, affording drainage of water from off and about the roots of the plant during the rainy and frozen seasons of the year. The usual mode of planting is to lay out the ground in rows, by a line seven or eight feet asunder, which is facilitated by drawing a piece of colored yarn or cloth in the line the distance of the rows apart, and placing a stake at each mark in the line as you proceed, while the line is set off at each end the distance desired for the row.

PLANTING

is done by selecting the roots of the previous year's growth, called *runners*, which are cut into pieces, with two sets of eyes to each section, and inserted with a *dibble* in the ground, with five sets in a hill, setting one at each corner of a square of six inches, and the fifth in the centre of the square, all in an upright position, with the top of each root inclining to the centre, with the eye buds pointing upwards, and all beneath the surface of the earth at least an inch.

The first season's planting is usually done with corn, potatoes, or beans, taking care not to encumber the "hop hill" with that of its neighbor from the other crop, as alternated by the planter in the rows; the after culture the same as for the accompanying crop of corn or potatoes, as the case may be. It is usual in the succeeding month of October to place over each hill of hops at least one or more good shovels-full of well-rotted manure for winter protection, and to enrich the ground for the benefit of the plant.

The succeeding season's culture requires more care and watchfulness, as a good crop of hops may be anticipated if all has been well attended to the previous season. After the ground has been ploughed between the hop rows, and as the plant makes its appearance above ground, the poles are introduced, with two at each hill, and inserted in the ground in perfectly straight lines upon each row, an incision being made with the hop-bar in the ground at the depth required for firmly holding the pole. As soon as the plants have grown from one to three feet in height they are tied with withered rushes (of the previous year's growth) to the poles, and subsequently again tied, until sufficient strength is acquired in the vine to force itself to its aerial summit for the production of its flowers; the culture in the meantime is performed with the horse cultivator and hoe, by keeping the ground clean. Most growers suffer but two vines to grow upon each pole, which is doubtless preferable to a greater number.

PICKING

usually commences about the first week in September, as the flowers become hard, and show an occasional tint of brown upon the outer side. The quality of hops is estimated by the abundance or scarcity of an unctious clammy powder which adheres to them, and by their bright yellow color, at which period they emit their rankest odor, and are considered ready for harvest. The picking is mostly performed by women, with the aid of men's help to extract the poles from the ground after severing the vines, and placing them upon a frame over a box, which is subdivided into four apartments, and accommodates as many pickers, with each a box three feet long, two feet deep, and eighteen inches wide, each picker filling the box two and three times during the day with well-picked, clean hops, for which they receive about twenty-five cents per box, though much of it is hired at cheaper rates and generally poorly performed, with an intermixture of litter and hops, which depreciates very much the value of the crop, and should be discarded for the mutual benefit of both the grower and consumer.

DRYING.

The operation of drying hops is not materially different from that of drying malt, and the kilns are principally upon the same construction, with stoves and pipe arranged in a room, and the hops laid or spread upon a cloth floor above, resting upon slats from eight to twelve inches in depth, where they dry in about twelve hours. Hops in their green state, if left standing long, are liable to become heated and change color and spoil; hence the kiln is kept in operation during both night and day, curing as fast as picked, at intervals of twelve hours for each kiln.

PRESSING.

Pressing into bales is performed at any time after drying, after they become cool; a bale generally contains about 200 pounds.

A very instructive article upon the cultivation of hops in England was published in the annual report of the Patent Office for 1857, in which is included the analysis of the hop and also of the plant, which the writer would recommend to the attention of growers for their instruction in applying manures to hop plantations. The analysis was taken under the direction of the Royal Agricultural Society of England. In comparing the tables of analysis we see that both lime and potash enter largely into the growth of both the plant and the hop, which should not be lost sight of in the selection of lands and manures to insure success in culture. The hop being an exhausting crop, will draw largely upon the cultivator in supplying waste to the soil. American culture is pursued in a cheaper way, and less of routine, than that of English culture, and if the American hop-growers would exercise the same discriminating care in the picking and curing of hops as the best English growers, American hops would annually become formidable competitors in the English market; whereas, under much of the present mode of indifference in culture by the American grower, American hops are only purchased in the English market when the foreign crop proves a failure. Another marked feature with all American growers is in raising all varieties in mass together, while the English keep distinct in their several plantations the "Farnham and Canterbury, Goldings, Grapes, Jones, Colegates, Flemish Red Bines," and many other cognomens too numerous to mention.

But whether any particular effect is produced in the real flavor of malt liquors by such nice discriminating distinction in the planting of select roots, as compared with an indiscriminating mass of the several kinds, is perhaps a matter of doubt and speculation, and to settle which needs experimental results and comparisons.

SORGHUM CULTURE AND SUGAR MAKING.

BY ISAAC A. HEDGES.

THERE are really but two varieties of the sugar-cane, commonly called *Sorghum*, in cultivation in the northern States of this Union, viz: the Chinese and the African. Although of the latter variety, introduced by Mr. Leonard Wray, of England, there were originally several sub-varieties, they are now fast becoming merged into each other, and their various shades of difference are becoming obliterated by hybridization, consequent on contiguous cultivation.

Since the first introduction of these plants into the United States I have been a careful observer of their habits and tendencies, with a view to arriving at a proper estimate of their relative values. As a result of these observations, I shall here state what I conceive to be the chief differences between the two varieties, in a *practical* sense; that is to say, those differences which render one or the other preferable as an article of cultivation to the sugar or sirup manufacturer. The Chinese cane seems more closely related to broom-corn than the African, and manifests a greater tendency to "crossing" and deterioration from contiguous crops of the broom; it is also very liable to be thrown down by the

winds, and to the production of large, gummy joints, which exercise a detrimental influence on the production of either sirup or sugar. The plant, too, when thrown down by winds or rain, in its efforts to regain the upright position becomes so crooked as to give great trouble to the workmen employed in handling the stalks. The African variety, or *imphee*, on the contrary, is much more vigorous in the stalk, and seldom falls before the wind; its joints are much smaller relatively to the size of the stalk, and its juices are more limpid and rich, generally showing about one degree richer in sugar, by the saccharometer, than the juice of the Chinese cane. Upon a deep, rich soil I have generally found the Chinese cane to be rank in growth, and yielding juice of inferior quality, which is difficult of defecation. Upon a similar soil, however, the African cane (several lots of which I have worked during the last fall) yields a uniform crop of large plants, which, although not perhaps as sweet as those grown on poorer soil, yield in the aggregate more sugar or sirup to the acre. Upon the whole, therefore, it will be perceived I give a decided preference to the African cane, or *imphee*.

It has been supposed by many that the introduction of these sugar-canes into France would lead to the abandonment of the cultivation of the sugar-beet in that country; but from a letter I have received from a well-known house in Paris, and which, as it has special reference to seeds, I here insert, it would appear that no expectations may be entertained that the cane will supersede the beet.

"PARIS, *September* 30, 1861.

"DEAR SIR: We have been favored with your kind letter, and are sorry to say that in some circumstances the Chinese sugar-cane, *holcus saccharatus*, has also degenerated here. However, these instances have been seldom until now. But for the same reason we could not engage to deliver you seed which would produce canes containing a certain percentage of saccharine matter. We should, if you favor us with an order, procure seed at best sources, and have no doubt we shall be able to supply you with the true and pure variety. We cannot grow this article ourselves; and besides, the seed of the pure variety having the same appearance and color as the degenerated one, we cannot ascertain on receiving it whether it may be recommended as entirely genuine. Even in case of its not being so, our correspondents may not be to blame, as plants having the appearance and look of the true kind, or being the true kind, may produce seeds which themselves will produce degenerated plants.

"The plant is not so generally grown in France as it was expected when it was introduced. The difficulty of converting the juice into sugar, and the comparative small use which is made of sirup, have been an impediment to the extension of its cultivation; nevertheless, we could procure you large quantities of seed at the price of $16 to $20 per 100 pounds. As to the *imphee* it is almost not cultivated by our agriculturalists; we could only send you small quantities of it. We hope you will favor us with an order, and you may rely upon our bestowing efforts and attentions on the same.

"Meanwhile, dear sir, we are yours, most obediently,

"VILMORIN, ANDRIEUX & CO.

"P. S.—Beet sugar is so very extensively produced in France (of which you are well acquainted) that the sorgho sucré, owing to the difficulties of the extraction of its sugar, could not compete in the north of France, and in the southern department nobody enterprising enough has undertaken the cultivation with means enough to his command to carrry his enterprise to a good end.

"V., A. & CO."

In my operations during the ensuing season, I shall use the seed of the *imphee*, of the third growing from Mr. Wray's importation. Out of six bushels, which I distributed gratuitously last spring, I have only been able to collect about twenty-five bushels—little more than enough to plant the five hundred acres required for my own works at Dayton.

I have induced several farmers who planted seed last spring to bury some of their canes for spring planting, as is the custom in Louisiana with the Indian sugar-cane; and as it may yet be found profitable to adopt this mode of culti-

vation with the *imphee*, I shall very briefly describe the method of the Louisiana planters. In Cuba the Indian cane is grown from the seed, and from the juices sugar is freely made; but in Louisiana the same seed sown proved a failure as to crop or sugar, and hence planting the cornstalks has been resorted to with the best success. The canes are cut before frost and buried in deep furrows formed at regular distances in the fields designed for cultivation in the ensuing season—in February, which is planting season in that latitude; the spaces between the furrows are ploughed and formed into furrows, for the reception of the buried canes; the old furrows are then opened, and the canes removed into the newly found ones, being arranged two abreast, and covered slightly with earth, by means of a light plough. From each joint of the canes, roots and a stalk shoot forth, which in due time are cultivated, cut, and submitted to the crushing mill. Now, upon examination of the *imphee* and comparison with the Indian cane, it will be perceived that the former possesses the same general characteristics and tendencies; and, therefore, equally favorable results may be expected from a similar mode of treatment to the latter; the coming season may confidently be expected to settle the question; and, in all probability, we shall have from such a mode of planting an earlier and superior crop.

To show the results already attained, I may mention that this last season I had cane stalks of one and five-eighths of an inch in diameter, which weighed four pounds seven ounces, and yielded juice marking 7½° Baumé.

For preparing seed I would recommend the use of a simple revolving cylindrical hackle, such as is used for cleaning the broom-seed from the wisp; this will not fully prepare the seed for planting, but will make it ready to be freed from the twigs or clusters which adhere, so that greater uniformity in planting may be attained. For this latter purpose I use a machine consisting of two vertical wooden plates, one of which is stationary, and provided with an opening in the back, communicating with a hopper, and the other revolving by means of a crank turned by hand. The revolving plate is held up against the stationary one by a spring of just sufficient strength to cause the seed to roll between without injuring it, and thus separating all the twigs and much of the hull. This separation of the hull from the seed of the *imphee* is rather a benefit than otherwise, as it enables the moisture of the earth to penetrate sooner, and thus hastens germination.

In order to the more thorough understanding of the subject, and for the greater ease of special reference and study, I shall divide the following essay into various parts or chapters, beginning with

SOILS AND SEASONS OF PLANTING.

In regard to soil, I would use a strong, warm, and rich soil, such as will generally ripen common corn early, free from foul seeds, and one which will stand wet seasons well. A sandy soil is preferred, but it should be rich; a clover layer is capital. This cane is much more likely to suffer from wet springs than from dry summers, and hence the above preference for a loose and porous soil. The ground for this crop cannot be ploughed too deep, as its roots penetrate to a great depth, even as far as three and a half feet, to which depth I have traced them. As before indicated, I am satisfied that the African cane will stand a much stronger soil than the Chinese.

It would be altogether useless to attempt the naming of any particular date for planting. Seasons differ; and therefore I can only say, plant as early as the ground by being dry and warm seems fitted for the seed, and then plant shallow—*very* shallow.

The seed should, previous to planting, be soaked in warm water until an appearance of germination is perceived. This in the *imphee* will require about two days; in the sorghum, nearly six.

It has usually been recommended to plant in rows running north and south, but from some considerations and facts occurring to me, I am inclined to prefer rows running east and west. The west wind storms are the most destructive, and a crop planted in rows running in the direction of winds will, of course, stand much better than one the rows of which are transverse to such direction. I saw one field this season in which the matter was fairly tested. In the portion planted north and south the crop was laid prostrate; in that part, on the contrary, wherein the rows ranged east and west, the crop was unmoved.

It is well to know that this cane will bear transplanting, as I have fully proven four or five years since. In this way missing hills may be supplied, or early crops grown, by starting in hot-beds, and transplanting in May or June.

I would specially caution farmers against planting seed without first having tested its capability of germination; then, having satisfied themselves on that point, let care be taken not to plant too thickly. If planted in rows, they should be fully four feet apart; and if planted in drills, about four or six inches between each seed. A reliable planter will pay his extra cost in the end; but, however planted, and by whomsoever, I repeat, *plant shallow*—not exceeding one inch deep, and half of that depth would be still better.

CULTIVATION.

The young cane plant is exceedingly diminutive, and is hardly distinguishable from the fox-tail or summer grass; hence the importance of having clean ground, wherever practicable. The plants require no other or greater attention in the way of hoeing or dressing than is bestowed upon Indian corn or broom-corn. Of course the amount and manner of such cultivation will differ in various seasons, as will be very well understood by those familiar with the cultivation of the latter crops. In some soils the cane is liable to "tiller," or, as it is sometimes called, "sucker." It will therefore be advisable to remove the young suckers, in order to permit the main plants to mature uniformly and vigorously, and also to facilitate the stripping and gathering. Where the suckers are permitted to grow up they detract greatly from the strength of the main plant, and impede the workmen in gathering the crop, as they are often in doubt as to which to select and cut; besides, if gathered along with the main stalks, and sent to the mill, they impart to the sirup a wild grassy flavor, together with an excess of acid, which is difficult to remove, and which proves a positive barrier to the manufacture of sugar.

CUTTING AND HANDLING.

As has already been intimated, in reference to the time for planting, the time for commencing cutting depends greatly on the season, varying as the weather has been more or less favorable for maturing the plant. Of one thing we are, however, certain, viz: that as soon as frost shall have killed the foliage and seed tufts, the cane will gain nothing by standing out in the hill; on the contrary, if the stalk has been frosted, and is left exposed to the warm sun, it will commence much sooner to ferment in its juices than if cut and stacked, or housed.

Previous to cutting, the leaves should be stripped off by hand, if desired for fodder, or, if they are designed to be left on the ground, by a smart stroke of a stick about four feet long. The seed heads, together with about four feet of the cane, should be cut off and tied into small bundles with the leaves; they are far better as food for every kind of stock than sheaf oats, and are richly worth saving. I am aware of a rumor which has gone abroad to the effect that they are injurious; and although the statement has a thousand times been refuted, I am still asked whether the seed will not kill cattle and horses. I once lost a valuable horse by feeding to him imprudently a mess of oats, and so, but *only*

so, it may be with this seed; yet, according to the proverb, "A lie once started, the truth seldom overtakes it."

After the canes have been stripped and cut, as above directed, they should be cut off near to the ground, and tied in bundles of twenty or thirty stalks, with the wilted leaves. Each bundle should be tied in two places, which will greatly facilitate the subsequent handling. In this condition the cane may be set up in ricks in the open air, or, preferably, under shelter, and kept for some weeks. Such keeping improves the juice not only in flavor, but also in saccharine richness, from one to three degrees. This improvement takes place upon the same principle and from similar causes which determine the sweetening of acid fruit after pulling, viz: the change of the gum and starch into sugar.

If, at any time while the cane is standing, a sharp freeze should occur, the whole crop should be slashed down and thrown into wind-rows, with the tops uppermost. If much difficulty should then arise in stripping off the leaves, the canes may be ground with the leaves adhering, but the tops should be freely cut off. All possible despatch should be used after freezing in getting the canes through the mill, lest a warm sun should come out, and fermentation and souring commence. The frost does no harm of itself, but when the warm weather follows the mischief is done.

In handling an extensive crop a dumping wagon will be found highly convenient. In the southern States they are in common use for the purpose.

MILLS AND GRINDING.

In all the sugar districts the mills used for expressing the juice of the cane have one common feature, viz: smooth iron rollers. In nearly all cases, too, there are three rollers in each mill, by which the cane is compressed two separate times. The rollers are named, respectively, the main, feed, and bagasse rollers. Although all the sugar mills possess this arrangement in common, they differ in some minor points, which will be pointed out in as far as they concern us in the present inquiry. In large establishments where steam or water power is the motive, and even in smaller establishments where animal power is used, the rollers are placed horizontally, and are fed with cane, and relieved from the bagasse by means of endless aprons. The bagasse is, in many cases, loaded into carts and hauled off. In other establishments, on the contrary, it is passed into suitable furnaces, where it is burned to generate steam for milling and for evaporating the juice. In the north a much smaller mill is used for crushing the sorghum; the rollers are set upright, and are held in position by strong cast-iron plates, while the boxes are set up by wedges or screws. These mills are fed by hand, and the bagasse is also removed by hand. In the larger establishments, already mentioned, the main roller of the mill is held down by a set of screw bolts, which pass down through the housing and firm timber beneath. In this manner the main roller is held down upon the bagasse roller with great force, while the feed roller is left free of the main about one-fourth or one-half inch. The canes thus enter between the feed and main rolls three, four, and six stalks in depth; the main roll is forced upwards against the caps, and the bolts tightly compressing the timber until an opening is made sufficiently large to admit the cane. Although I have suggested to some of our manufacturers at Dayton the introduction of this feature into the upright mills of the north, it has not yet been introduced; but I doubt not it will soon be acted on, and most probably during the ensuing season. In the upright mills now used in the north there is no yielding; and, as of necessity the feed must be irregular in thickness, there is great liability to breakage, or to a waste of juice from insufficient compression. During my operations in the past season with my (horizontal) mill, I found a continual waste of juice upon each end of the rollers. The hopper was some three inches narrower than the length of the

rolls to avoid the spread of the cane passing off, and I found always a wet or half pressed margin passing through. This defect I remedied by flanging the lower rolls, and cutting the upper one to work closely within the flanges; then, by placing thin plates in the hopper to pass inside the flanges, I found much more cane could be crushed in a much more uniform, cleanly, and economical manner. I am satisfied that this feature must be embodied in the vertical mills in order to improve and perfect their working. Another difficulty in my present mill I find to arise from the small size of the rolls, which are but fourteen inches in diameter. Now, with such small rolls, the opening by which the cane enters is so quick in its turning that a large cane can scarcely be forced to enter; by making the main roll, say twenty-four inches in diameter, and the others about fourteen, a better opening and larger curve will be obtained for the feed-cane, which will greatly facilitate the uniformity of feed—always a very desirable thing. With rolls of larger diameter the lengths need not be so great as at present used.

Premising that in the construction of crushing mills the foregoing suggestions are embodied, I am quite certain that the milling of cane may be profitably accomplished. Yet, by not attending to a few simple and plain considerations, many have committed great mistakes against their own interests in this pursuit. This they have done by being governed in their choice of a mill rather by the first cost than by the capacity of the machine and its durability. Now, when it is considered that, in order to feed even a small one-horse mill, a full hand is required, while the product of such a mill is only forty gallons of juice per hour, and, on the other hand, a mill driven by four horses, and producing one hundred and fifty gallons of juice per hour, can be equally well fed by one man, it will at once be seen that the owner and worker of a small mill is at a serious disadvantage in regard to the cost of labor. The same principle applies throughout the entire sugar-producing works in every department, viz: that works of greater capacity are more profitably carried on than smaller ones. In the construction and arrangement of the entire works of a sugar or sirup manufactory, ample strength and complete adjustment of the several parts is a very important matter; for, as each operation therein is dependent upon that which precedes it, or is itself necessary to the subsequent and depending operation, a failure in one part, resulting in a stoppage of only a few hours, may, by the multiplication above indicated, be productive of much loss.

In reference to the speed at which mills should be run, and to the manner of gearing, driving, &c., I shall only throw out a few suggestions; some of them suggested by theoretical considerations, but the most of them by practical observations, and then close this portion of the subject.

Where horse power or oxen are used, I should always prefer the vertical mills. In their use I would use a long sweep—say sixteen feet—which will be found most profitable and convenient, as it necessitates a slow motion on the part of the animals, and, moreover, permits a load of cane to be dumped inside the track, and near the feeder, so as to render unnecessary an assistant or carrier. The motion of the rollers can scarcely be too slow. I would designate twenty feet per minute as the greatest speed admissible, although in my own works I shall not use a greater speed than twelve feet per minute. Water will resist a quick motion and pressure, but it will yield freely to a gentle pressure. I have often been asked to fit up mills to be run by thrashing powers, which are geared up to a quick motion. These require to be back-geared again to such an extent as to give only the movement of the horses or cattle, viz: about three revolutions per minute, which, with rolls of twenty inches diameter, give about fifteen feet per minute. The rolls should in all cases be so adjusted as to permit rather thick feeding than otherwise, thus causing a close pressing of the canes; and in this way a larger yield of juice will result, more free from gum and green fibre than is obtained by the common method of close rollers and thin feeding.

EVAPORATORS, AND MODE OF USING THEM.

In the evaporating houses of Louisiana it is most common to use a series of five large kettles, arranged in a train over a flue. The kettles vary in size from eight feet in diameter down to four; sometimes the train consists of six kettles. The train of pans or kettles occupies a length of about thirty feet, and the construction of the furnace and flue beneath is such as to admit of the whole range being wrapped in a volume of flame, which gives off an intense heat. The largest pan of the series, having a capacity of, say, three hundred gallons, is placed at the greatest distance from the furnace, while the successively smaller pans are arranged so as each to approach nearer to the source of heat, until the smallest of the series is placed directly over the fire. The largest pan is called "grand;" into this the cold juice from the mill or tank, having previously been treated with lime, is first run. After boiling so as to raise the scum, which is at once removed, the juice is thrown forward through the successive pans, which are each in their turn skimmed, until it reaches the smallest pan, called the "strike" or "battery." Here, being directly over the fire, it is caused to boil with great energy until a sufficient amount of concentration is attained. The fierce and energetic ebulition of the clarified juice is found to be essential to good success in sugar making.

Previous to my visit during the past year to these establishments I was inclined to believe that the above method could not be followed in the treatment of the juice of the northern-grown cane; that is to say, I supposed the method of submitting the juice to a more rapid ebulition as it became more concentrated would be inapplicable and impracticable. During my operations in the past season, however, I have, by repeated experiments, become convinced of the entire practicability and fitness of that method.

The operation of evaporation is in the north, in most cases, conducted by the use of shallow pans, and, for the most part, these answer a good purpose; but from the fact that the manufacture of sirup from the sorghum has been hitherto regarded in the light of an experiment rather than as a tried and safe investment, the pans and other utensils have generally been of a slight and unenduring construction, and the *fixtures*, from their slightness and *portability*, have been anything but that which they were designated. Now, however, we may without presumption look upon the experiment as successful, and may prudently advise that the works and machinery be constructed in a more substantial manner; and, although, perhaps, upon a scale of dimensions smaller than those of the south, with a view to economy of arrangement and duration.

Two main objects should be borne in mind in the construction and placing of pans, or evaporators, viz: to use up all the heat of the furnace, and to give full employment to the attendant. I made one pan, for experiment, twelve feet in length, and three feet in width, thus exposing a superficies of thirty square feet to the fire; yet I found that the flame from the furnace passed ten feet beyond the pan, and then entering the flue of a steam boiler twenty-six feet long, soon raised steam therein, and in its mate, to four pounds pressure. In this pan I could make fifty-four gallons of sirup in six hours by burning a half cord of inferior wood; now, had my pan been constructed of a length of twenty-five or thirty feet, I should have been enabled, with the same fuel, to make from seventy-five to one hundred gallons of sirup in the same time. The furnace in the above case was twenty-four inches in vertical height, and deep enough from front to back to receive four-foot wood; larger furnaces with large doors and correspondingly capacious ash-pits, good gratings, and so forth, will be found still more economical. The inside of the furnace and flue should be constructed of fire-bricks, and be well supported by outside work, anchored together and made firm; the door frames should be secured to the brick-work by iron anchors.

During the past season I used for my principal work in evaporating, steam, applied through brass tubing 1¾ inches in diameter. I had two pans in use, each four feet in width, the larger one fifteen feet long, and the smaller one eleven feet. In each pan there were twelve lengths of tubing as above described, through which the steam was applied; the tubing being, however, about two feet shorter than the pan for the purpose of leaving a cool end, into which the cold juice could be introduced from the mill or tank. At the cool end of the pan, the side or end is made sloping for convenience of removing the scum which rises to the surface during the boiling. By having one end kept comparatively cool and tranquil, while at the other the ebullition is kept up energetically, the removal of the scum is much facilitated, for it glides rapidly from the turbulent surface of the boiling liquid to the comparatively still surface of the cooler part of the pan; here it is removed by the attendant, who uses by preference, a light floating wooden scraper* of the width of the pan, scraping it over the sloping end, whence it falls by proper conduits to a suitable tank placed for its reception. This scraper, which, by an accident explained in the foot-note, I was led to adopt, may be constructed of light wood, made more buoyant by means of cork floats adjustable on each end; it should entirely float on the juice, and thus it will rake off only the scum and froth floating on the surface. It will be found greatly preferable to any perforated skimmers, which, being of iron, tax with their weight the strength of the operator, and if finely enough perforated soon become clogged with the gum and feculencies in the scum.

In the large pan, which I will call "grand," the juice should be inspissated to about 15 degrees Baumé *while hot;* and then should be drawn off by a gate in the foot of the pan into a tank, where it may be left for one or two hours to clear by subsidence. From this tank, after subsidence, it should be drawn off into the smaller pan, which, for convenience of reference, we shall designate "strike," and which holds sufficient for, say, thirty gallons of sirup. Here an examination should be made as to whether the sirup is acid, when, if so, more lime should be added; it is preferable, however, as I shall show under the head of neutralizing and defecation, to complete the neutralization in the "grand."

In the small pan, or "strike," the boiling is conducted gently at first, until all the remaining scum is removed; it is then caused to proceed rapidly and violently, for the purpose of throwing off the grassy and unpleasant odor and the peculiarly caustic vapor of lime, which, if suffered to remain, would impair the flavor of the sirup; furthermore, a lengthened continuance of heat is detrimental to the quality and appearance of the sirup.

Having thus reduced the sirup, by evaporation, to about thirty-six degrees Baumé,† it should be struck off through a cooler into suitable barrels or tanks. The barrels for storing sirup should be well constructed, fully hooped with sixteen hoops, and made from red-oak by preference; the bottoms and heads should have at least one board of pine therein, or they will be sure to leak; whiskey barrels are not by any means the most suitable things for the purpose.

The bottoms of pans should be made somewhat trough-like, to facilitate the discharge of sirup; and all the valves or gates through which juice or sirup is

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* Although apparently irrelevant here, I will warn manufacturers against the use of coal oil lamps in their manufactories at night; not from any unsuitability of the oil itself, but from the inevitable breakage of the glass chimneys consequent on the impingement of *steam* against the same when urged by a draught of wind. The cost of glass chimneys was greater during the time I used coal oil, than the cost of oil. Once, by such an accident, I was left in total darkness, at a time when delay would have ruined a boiling of sirup; in the darkness I seized a wooden rake to skim the pan, when lo! I found it to float and skim as neatly as if guided by a practiced hand in full daylight; further reflection led me to the invention of my floating skimmer.

† Saccharometers differ, and should be tested before relying on their indications.

discharged should be large, of not less than twelve or sixteen inches superficial area. This is dictated by the consideration that while in full operation a few minutes become of importance when it runs throughout the entire works.

Evaporating pans may be constructed of like form to those already mentioned, and set over a furnace; they will work quite as well thus, with perhaps one exception, viz: the facility of controlling the ebullition. It is very common to use thin, galvanized, or plain sheet-iron for the bottoms and plank sides for evaporators; yet, however well they may answer the purpose of experiment, they are subject to too many accidents and strains to serve an economical permanent purpose. When of sufficient length for large batches, the expansion of the iron is so great as to cause a displacement on the walls, destroys the fastenings and causes leakage; and in addition, the rust of one or two seasons will destroy entirely its integrity.

I should recommend that pans be constructed of thick plates, not less than one-eighth inch, with rivetted and caulked joints, after the fashion of steam-boilers. For larger pans, of say four feet width and thirty feet in length, iron of one-quarter or three-eighths would be preferable, although the sides need not be so thick. In all cases two pans should be used, viz: a "grand" and "strike," each set upon a separate furnace, with doors amply large to enable the attendant to cool down his furnace by introducing bagasse whenever he wishes to strike off a batch of sirup.

With two such pans, viz: a "grand," four feet by thirty, and a "strike," thirty inches wide by twenty feet long, each well set on a proper furnace and properly attended, three hundred gallons of sirup may be turned out in each fifteen hours, with a consumption of, say, four cords of wood. A mill with rolls of fourteen inches diameter, twenty-two inches long, with master roll twenty or twenty-four inches in diameter, driven by a six-inch engine, or by six horses, on a lever sixteen feet long, would be required to supply such an evaporating apparatus, and may by them be kept fully employed.

GENERAL ARRANGEMENT OF SIRUP AND SUGAR ESTABLISHMENTS.

Seeing that the cultivation of the sorghum and the manufacture of sirup therefrom has now become in the north a settled matter, we are met by the very legitimate inquiry, "Will it pay?" and if so, in what manner shall the procedure be arranged and conducted? In reply, it may be affirmed that it can only be made to pay when conducted in a well-arranged establishment, according to a good method or system. The cane possesses in its juice an amount and quality of saccharine matter not equalled even by the sugar tree; it needs only to be purged of all offensive matters to insure its finding a ready market, and taking the place, not only of ordinary molasses, but also of the choicer sirups.

As I have elsewhere previously intimated, the apparatus and establishment generally should be of sufficient magnitude to give as full employment to each person engaged as they would have when engaged in the harvest field. This is an all-important consideration, and even should it require the concentration of all the surplus capital in a neighborhood to establish and carry on such works, it had better be done, than that a number of diminutive establishments should be started to prove so many failures.

In nearly every settlement of medium magnitude there is to be found a stream of running water, or idle steam power, which for two months in the year can be applied to the propulsion of the crushing machinery; where, however, such a stream is not conveniently applied, the mill may be worked by four or even two horses. The former will supply enough juice for nearly two hundred gallons per day; the latter for about one hundred and twenty; a one-horse mill I should consider to be but a throwing away of money.

In the selection of a site for the erection of a large establishment it is well, if possible, to secure an abrupt bank, of say fifteen or twenty feet in height, for

the situation of the crushing mill. This will save the labor of elevating either the cane or the juice, and the fall here indicated will be all required for passing the juice into the barrels or tanks. In Louisiana this arrangement is very common, and should always, when possible, be secured.

As to the extent of ground required, I should say two acres would be sufficient for cane-yard and sheds. The mill should be situated at one end of the cane-yard, with about one hundred feet of endless apron, running back therefrom into the yard. At each side of this endless feeding apron the cane may be ricked up at right angles; a narrow passage only being left for a feeder to walk in. The cane ricks may extend fifty or more feet each way, and it will be found much better thus to set the cane on end than to pile it horizontally, for in the former method of arranging it, should a frost occur, it catches only the tops and the outer bundles; these can soon be worked up and no harm be done.

The building, which should be as close as convenient to the mill, may be built about sixty feet by forty, and about twenty feet high to the eaves. It is likewise well to provide a large tank, or reservoir, wherein, by having a mill of large enough powers, a supply of juice can be stored during the daylight for boiling at night by artificial light. Thus provided, the yard and mill may be closed up at dark, and the operations by night rendered more simple and economical. It will be found here, as in all other works where large fires are required, exceedingly wasteful to suspend the works during the night, as the walls of the furnaces, having a great capacity for caloric, are long in heating up, and hence, when once heated, should be kept from cooling off. In some establishments the bagasse is used for fuel, and in proper furnaces, which will be noticed further on, it is profitable so to use it; an endless apron should be laid, to work between the mill and furnace, to convey it directly to the latter. Where it is not so used, either a cart and horse, or other conveyance may be used to convey it to its destination. An endless apron may deliver the bagasse from the mill to an elevated tilting platform, where the cart or wagon is to be loaded therewith.

In situations where it is impossible to have the mill set upon an eminence, as heretofore indicated, it should either be elevated on masonry, or framework of sufficient strength, in which case the cane will require to be elevated on inclined aprons; or, the mill should be set over a sunken cistern, into which the juice can run, and from whence it may be elevated by pumps to a reservoir placed at a convenient height. My own works in the past season were constructed on the last-mentioned plan; the cistern below the mill was of the capacity of three hundred and fifty gallons, and the reservoir of twenty-five hundred gallons, both being constructed of 1½-inch seasoned pine, well painted with red lead and boiled oil, and they were found to be very close and serviceable. The pumps for elevating the juice from the cistern to the reservoir should be constructed of large bore, if circular, at least five inches in diameter, of firm and sound timber. They should be operated slowly, the motions of the piston not exceeding twenty per minute; when they are operated quickly, the juice is found to foam, and this in warm weather is apt to hasten fermentation.

Although, not here in the proper place, I may mention, while speaking of the construction of tanks, that my pans, heated by steam pipes, were constructed of 1½-inch pine, and painted with red lead and oil, they lasted well, and scarcely leaked at all; but the hot sirup contracted the bottoms, and made them irregular. I should, therefore, in future use copper, or iron pans; nevertheless, for *experimental* purposes, wooden ones are less expensive, and more easily altered than those constructed of metal.

In making the calculations for height, or elevation of reservoir, we must consider the number and positions of the various vessels through which the juice must pass before reaching the barrels in the form of sirup. Beginning then with the "grand," which may be situated on a level immediately below that of

the reservoir; from the grand, after boiling, the juice is run off into a subsiding or precipitating tank, which I shall name the "prop;" from prop, the juice, after subsiding, is run into the "strike," or battery; after the sirup has reached the requisite degree of concentration in the "strike," it should be *quickly* run off by large gates into a shallow "cooler," of, say, ten inches depth, and thirty feet of surface; as soon as the sirup in the cooler has reached a temperature of, say, 130° Fahr., it may be run off into the casks* by means of a funnel. Commencing, therefore, with the height of a cask, with a funnel in it, we must add the height of the cooler, then the height of the strike, to this the height of the precipitating tank, and lastly adding the height of the grand we shall arrive at the proper elevation of the floor of the reservoir. Of course, we shall in each case add a little for fall, or draw off. In approximate numbers, the battery, where steam is used, should be twenty inches; prop, fifteen; grand, eighteen; and reservoir, thirty or more inches.

As regards the disposal of the skimmings, which, by the way, are much too valuable to be thrown away, I shall speak in another part of this essay. Here, however, it will be proper to say that a suitable tank should be provided wherein to collect them as they are removed from the various pans.

By means of chimneys, or flues, made of common "domestic" and arranged over the various pans, leading off through the roof, I was enabled to conduct off the greater portion of the steam, and thus prevent its diffusion throughout the whole atmosphere of the works.

It is very desirable to have, besides the conveniences already enumerated, suitable sheds for storing the cane in; by such an arrangement the working season may often be prolonged into the month of January.

A word here relative to small establishments, and I shall close this part of my subject. Where horse power is used for crushing, it is well if the mill can be set on an elevation, as before explained; failing this, pipes of tin or other metal should be laid under the track to conduct the juice into a tank, whence it may be elevated by pumps, &c., as before described. In all cases, both in large and small establishments, care should be taken to plan everything in such a manner as that no hindrance to one part shall result from a failure in the other, and thus lead to a multiplication of the stoppage into the number of processes or hands employed.

DEFECATING AND NEUTRALIZING REAGENTS.

Upon these subjects much has been said and written, and many are the pretended discoveries, especially in regard to defecating, which have been published. I find, however, that the well-directed application of heat is the greatest of all defecators, or, as some call it, clarifiers. The natural acid of the cane, which is more abundant than is generally supposed, acts as a serious obstacle to defecation; and, according to my experience, it is very impolitic and nearly impossible to inspissate the juice without a very near approach to neutralization. Lime—the ordinary quicklime—I have found to be the best reagent for this purpose. Soda, in the cheapest form, is much more expensive than lime, and, being a carbonate, has the fault of producing effervescence; moreover, when used to excess, it leaves a flat, alkaline taste, which is not the case with lime; lastly, in no respect does it serve a better purpose than lime.

Bisulphate of lime has been used to considerable extent in Louisiana, and although it favors crystallization, yet it produces a softer grain of sugar, and is, in some other respects, inferior to the simple lime process. It has also been used experimentally in the sorghum works, but I am unwilling to recommend its use from any evidence yet adduced. Very many persons unacquainted with the

* In another and previous section I have spoken of the construction of the molasses casks.

chemical changes that take place when lime and acid are commingled, seriously object to its use, they supposing that the lime actually remains to be digested in their stomachs, while the fact is that a perfect neutralization takes place, and nothing but a neutral sediment remains, which generally attaches to the pan, or pipes, or settles in the "prop," if allowed to do so.

It is a great pity, and rather detrimental to the immediate success of this crop, that several parties engaged in the manufacture of apparatus have, doubtless in good faith, strenuously urged the disuse of all alkaline or other defecating reagents. The result of such a direct inspissation, it is true, is a sirup of somewhat lighter color; but it is less sweet, in the direct ratio of the free acid contained in the cane; and, moreover, the sirup so made contains within itself a *ferment* which, unless the sirup has been concentrated to an undue thickness, will make it work, and become tart in summer. This fact has led many to suppose that the sorghum sirup could not be made to keep good in warm weather, and that the rank herbaceous flavor could not be removed.

During the past season I have rehandled several barrels of such sirups. On adding about eight gallons of water* to each barrel, and about six quarts of lime-water of 4° Baumé, and applying a boiling heat, there rose to the surface a thick, green scum, and in the steam a very offensive odor escaped. From each barrel I usually found about four gallons of this scum to separate; and the sirup changed by this treatment from a fair straw-color, with a greenish tint, to a deeper color, rather amber in tint, when seen in thin strata; at the same time, from being turbid it changed to something approaching brightness. I have never met with a thoroughly clear sirup manufactured either with or without the use of neutralizing or defecating agents; a cloudy ingredient seems to remain suspended, which, when it subsides, has the appearance of buckwheat flour.† The filter seems necessary to remove this.

Albuminous substances, such as eggs, blood, &c., have been used from time immemorial for coagulating and removing scums; the first of these is too expensive except for laboratory use, on a small scale, and the latter is not always to be obtained. On experimenting with bullock's blood, I found it to determine the separation of a large quantity of scum, without, however, rendering the sirup perfectly bright and clear. After filtering, however, through animal charcoal, the remaining cloudiness is entirely removed, and the sirup is left bright, of an amber color, and having a most pleasing flavor—of a quality to insure its being found, when produced in full quantity for the markets, on the tables of our best hotels and families.

It is difficult to indicate with exactness the quantity of lime requisite to neutralize the acid of the juice, as for different samples grown in different seasons or localities a different quantity is required. The litmus paper‡ in the hands of beginners, and probably in those of old operators, will be the best guide, and, like the saccharometer, should never be absent from the works. My practice is, to add the lime-water by instalments in the "grand" boiler, until, upon testing

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* This addition of water is in order to permit of reboiling, and for no other purpose. Here I would mention that by merely reducing sirup with water, and reboiling to the same consistency, a darker sirup will result; and so in working cane wet with rain water, a darker sirup will result.

† This powder, upon being submitted to a rough qualitative analysis, proves to be lime, in combination with an organic acid agglomerate around particles of the cellular and fibrous matter of the cane.

‡ To make the litmus paper, procure half an ounce of *litmus*, which all druggists keep for sale in cities and will send by mail for a few cents; infuse this in hot water for about ten minutes, and then in the clear, blue liquid decanted from the dregs immerse unglazed white paper and hang it up to dry. It should be of a full, pure *blue* color; cut it in strips of convenient size, say one inch by three or four inches, and it is fit for use. Preserve it from light and air, or it will change color and become violet. To use, dip one end of a strip in the liquid to be tested.

with the litmus, the juice changes the *blue* color to a *purple*. Before adding the lime the juice changes the paper to a bright pink color. Practice will soon indicate the proper colors to be sought for, and in testing it will be well to dilute the inspissated juice with water, as its own color is apt to be mistaken by beginners for the effect of an acid reaction. In making lime water for neutralizing it will be found that, as the water only dissolves a very small quantity of the lime, the remainder settling to the bottom of the vessel, it is better to agitate before using, whereby a larger quantity of lime, being held in *suspension* by the water, will be introduced into the sirup or juice.

DISPOSITION OF THE SCUM FROM THE EVAPORATORS.

The best use of the scum, so far as I have yet been able to determine, is to ferment it, and then allow it to turn to vinegar. The scum contains more saccharine matter than the juice of the cane; it possesses, also, some essential oils, which, during the process of fermentation, become converted into ethers, which flavor the vinegar and give it a vinous odor very agreeable to the senses. In my own experiments I found the scum to make about an equal number of barrels of strong vinegar (stronger than that made from cider) as were made of sirup. As the scum comes from the pans hot it will soon commence fermenting, but will need to be reduced with water until the saccharometer stands at about three and a half degrees Baumé. If exposed in this condition in shallow vats to the air at a proper temperature, fermentation will advance rapidly, and soon acetification will set in, continuing until all the alcohol has been changed to acetic acid. In about eight days it will have the appearance and much the taste of good cider, and may be racked off into casks.

Doubtless vinegar could be more rapidly made from the diluted scum by the German or quick method, which may here be briefly described for the benefit of those desiring to engage in the manufacture. Premising that acetic acid is the result of the oxygenation or oxidation of alcohol, itself the product of the fermentation of saccharine liquids, it is evident that any method whereby a large surface of the alcoholic liquid is brought into contact with air at a proper temperature must be capable of quickly making vinegar. To this end large casks, water-tight in the lower part, are perforated with auger holes in great numbers, and, being fitted with a perforated or false bottom and with a stop-cock or faucet, are filled with beech or other non-resinous shavings, (which should have been well steeped in hot vinegar to begin with.) On top of the cask a tight wooden tray is set, having holes perforated in its bottom, through which cotton wicks are passed hanging down into the cask below. The alcoholic wash, being poured into the tray, percolates through the wicked bottom, and trickles down the shavings into the bottom of the cask; in its course it has come into intimate and large contact with oxygen, and hence will have been changed in great part into vinegar. On being drawn off by the stop-cock, and allowed again to drain through the tray and cask, its complete acetification will have been accomplished in the course of, say, thirty-six or forty-eight hours, at most. As the most barefaced mixtures are now commonly sold in our large cities for cider vinegar, it is evident that a ready sale will be found for a wholesome article which can be sold at a cheap rate.

Others propose to convert the scum into spirits for distillation, either as rum or alcohol. The juice of the cane, when fermented and distilled, will yield about the same *measure* of proof spirits as, when concentrated by boiling, it yields of sirup. Or it may be used to fatten hogs; in this case it must be fed to the animals soon after being removed from the pans, or its qualities will be deteriorated, and it may possibly intoxicate and render the swine "disorderly" or "incapable."

As a matter of economy the scum tank should be provided with a stop-cock at the bottom, by which, at the end of every few hours during working, a quantity of clear juice may be recovered and returned to the pans. The entire contents of the tank should, however, be discharged each day to prevent sourness. The scum from the "battery" should in like manner be racked off, and the floating part be returned to the "grand" for further extraction. Only the scum from the "grand" should be thrown into the "scum tank."

BAGASSE FOR FUEL, AND OTHER USES.

The amount of bagasse, or pressed cane-stalks, in a large manufactory is very great, and hence its disposition and uses become matter worthy of consideration here. In my own works, small though they were, the amount turned out from the mill in one hour was, by actual measurement, 2,375 pounds, which considerably exceeds the weight of a half cord of green wood, and besides contains less water. I disposed of all my bagasse to a paper manufacturer for nothing, except the convenience of having it removed without expense. In combination with rags, he told me that it made an excellent wrapping-paper; of course, the pithy portion of the cane was useless in the manufacture of paper.

It is evident, from the foregoing statement as to the weight of bagasse accumulating in a large manufactory, that a considerable saving of fuel might be effected by using it for that purpose; the large amount of water contained therein renders its consumption in ordinary furnaces uneconomical, as the water in evaporating abstracts a large portion of the heat generated by the combustion of the carbonaceous and hydrogen compounds. In Cuba it is customary to dry the bagasse in the open air, and afterwards to burn it in the evaporating furnaces; but both theory and experiment have demonstrated that, when burned in a suitable furnace, the wet bagasse generates a much greater amount of heat than when burned in a dry state; for, as the water is compounded of oxygen and hydrogen, if, instead of evaporating it as steam, it is decomposed, the oxygen is made to combine with the carbonaceous matters of the cane, and afterwards the hydrogen of the water is caused to combine with atmospheric oxygen, we shall *at least* save the caloric necessary to evaporate the water, and probably gain considerably from the more perfect combustion of the carbonaceous material thus made to take place.

There are several methods in use in the southern States for the burning of wet bagasse. The most successful furnace* for the purpose which I have seen is made somewhat as per the following brief description: The furnace consists of two parts, viz: the fuel chamber, or decomposing retort, and the mixing chamber; the former is erected in front of and about fifteen feet distant from the steam boilers or kettles; it consists of a chamber, say six feet square and twelve feet high, arched or groined over the top, and having an opening at the centre of the arch, through which the bagasse is admitted, at the same time keeping the opening closed. About five or six feet below this arched roof a skeleton groining of fire-bricks is constructed, eight ribs coming from the angles and sides and meeting in a well-hole in the centre; below this, say a foot below the springing of the ribs, a set of fire-bars is constructed, and beneath all a capacious ash-pit. A pair of doors are provided to this furnace for admitting wood or other fuel, in order to get up the first heat necessary for decomposing the wet fuel admitted by the roof. From the retort or chamber just described a flue proceeds, going backwards and sloping downwards into another apartment, called the "mixing chamber." In this chamber the highly heated carbonic oxide and hydrogen

* In, I believe, the September number of Silliman's Journal for 1860 there is a description of a wet fuel furnace; perhaps the same as I here describe, but of that I am not certain.

generated in the first chamber meet with a full supply of oxygen admitted from without and become thoroughly consumed, generating during the combustion a very intense heat. It would be out of place here to discuss the interesting series of reactions and decompositions taking place and on which this furnace is constructed. I shall therefore pass on to—

REFINING PROCESSES AND MATERIALS.

The best method of refining which has come under my observation so far consists in the use of the creased bag-filter, and afterwards of the bone-coal filter. The bag-filters are constructed of canvas, like a long grain sack. They should contain about two widths of canvas, and be of the length required; before use, they are introduced into a narrow sleeve, also of canvas, say six or eight inches in diameter, with open mouths. The whole filter is suspended from a vertical frame, with proper mouth-pieces to facilitate the filling. By this arrangement a large surface of canvas is furnished to the sirup or juice to be filtered.

The juice from the "grand," after being allowed to stand for some time in the "prop," so as to separate as much as possible of the impurities by subsidence, is poured *hot* into the bag-filter and allowed to percolate through, by which a considerable quantity of the impurities are removed; the sirup or juice, after coming from the bags, is transferred at once to the coal-filters, which are constructed as follows: the case is in the form of an upright cylinder, constructed of heavy sheet-iron, rivetted and caulked at the joints; the ordinary size is about seven feet high and four feet in diameter; but, of course, they may be made of any desirable dimensions. Previous to filling with coal, a perforated board bottom, on brackets, is introduced, (being raised a few inches from the bottom of the iron cylinder,) and on this a thick woollen covering, say, of blankets or carpet, is spread for receiving the granulated animal charcoal. The charcoal should be filled in up to the top of the case, and be formed into a concave at top, four inches deep in centre. On the coal carpets or blankets should be laid, and thus arranged the filter is ready to receive the sirup to be refined.

The sirup from the bag-filters should not mark much over 20° Baumé, and should be passed into the coal-filters hot, in a stream not larger than would pass through an opening half an inch in diameter, under a pressure of one foot. A larger flow than this would wash the coal too much, and would be useless as regards filtration. The filtered sirup should not be started to run off until the coal is covered entirely with sirup, and then the stream should be slow at first. If small coal seems to pass with the sirup, stop running, return that which is already drawn off to the filter, wait an hour, and try again. If now the sirup comes off clear, adjust the supply and draw off so as to equal each other, and leave the process to itself.

After a quantity of sirup sufficient, when fully concentrated, to fill entirely a filter case of the size you are using has passed through the filter the supply should be stopped, and hot water substituted and continued until what runs off does not mark more than 2° Baumé. The stream below should then be turned off, the washings being used for vinegar, or otherwise, as they will scarcely pay for re-concentration.

The sirup from the filters must now, without delay, be boiled to the required degree of concentration, as if kept long it may become sour. And here the use of a vacuum pan would be found to produce the most pleasing results in producing a light-colored and finely tasted sirup. The high temperature, 225° Fahrenheit, required for boiling the sirup in the open air tends to caramalize a considerable portion of the sugar, thus imparting the brown color and burnt flavor. For making sugar the sirup needs to reach a higher temperature

than that named, going even as high as 232° Fahrenheit. In the vacuum pan the temperature need not be much higher than 150° Fahrenheit.

And here, speaking of temperature, it is well to note that the common thermometers are frequently false in their indications, and should be verified by some good instrument. Apart from the inaccuracies of thermometers, however, it is difficult by their indications to know quickly enough when to stop the process of boiling. In Louisiana, I observed that the "strike" was frequently made under the direction of negroes, who judged entirely by the eye and touch; and seldom was there any difference observeable in the different batches.

Now, although the sirup made directly from the juice, without filtration, is a good article and will ever find ready sale, I doubt not that filtration will so far improve its appearance and quality as amply to remunerate the manufacturer for the extra labor and outlay necessary. I shall therefore here introduce a brief sketch of the method of making bone-coal, and also of the method of reburning the coal which has already been used as a filter. I am led to do so from the consideration of the probability that ere long we shall have many large and well arranged establishments in this country, each of which will be self-sustained, making their own charcoal, re-burning it, refining their sirups directly from the "grand," then passing it into vacuum boilers and concentrating for sirups, and also for granulation. In a refining establishment where steam-power is used few hands are required, as compared with those needed in a boiling-house.

THE MANUFACTURE OF BONE COAL AND ITS REVIVIFICATION.

Unless some more cheap and efficient filtering agent is discovered, we shall have to rely mainly on bone charcoal in our refineries. The manufacture of this material is one of great simplicity, and is conducted as follows: premising that the long bones, consisting of compact bony substance, as the leg-bones, ribs, jaws, &c., are best adapted to the purpose; skulls and weather-beaten bones are not of much use.

Perhaps the simplest and best retorts in which to heat the bones are cast iron pots, of a size convenient for handling, and, say, half inch thick; these being filled with bones are piled one above the other to a height of, say, fifteen feet, the top one being provided with a cover. Any crevices between the pots are filled with fire-clay mortar, and any number of stacks are to be enclosed in a cupola, heated below by coal or wood. A steady heat must be kept up in the furnace until nothing seems to escape from the pots except a pale blue flame, which indicates the completion of the charring process. The fire must then be withdrawn, the cupola opened up, (having been closed meanwhile,) and the whole allowed to cool. The pots are then taken down and emptied, when their contents are ready for the granulating mill.

The granulating mill is simple, like a bark-mill or corn-crusher; the object being to reduce the coal to the size of hominy. After granulating, the coal is passed through sieves or bolts of different gauges. The coarser part is used for filters; the finer is ground and sold for the manufacture of shoe-blacking, &c.

Instead of using cast-iron pots, as before described, some use old boiler tubes or flues. These are not so durable, but at the same time are not so costly.

The coal which has been used to the extent of rendering it useless for further filtering may be again rendered as good as new by reburning. To this end, after it has been washed, as directed under the head of "refining processes and materials," it must be removed by the manholes provided for the purpose near the bottom of the sheet-iron cases, and transferred to the retorts for reburning. These retorts consist each of a cast-iron conical pipe about seven feet long, five inches in diameter at the lower end, and seven or more at the top. Any required number of these retorts are arranged vertically over openings in a cast-iron bed-

plate, to which they are secured by flanges. The bed-plate is supported at a height of, say, two feet from the ground, so as to admit the contents of the retorts to be discharged downwards, by withdrawing a slide from under their mouths. Covers are provided for the tops of the retorts, and are closely fitted thereon during the burning. The furnace for heating these retorts is placed alongside, to the right or left, and the flame therefrom is passed over and among the retorts, which are heated thereby, and, communicating their heat to their contents, char and decompose the same, driving off the gaseous matters retained from the sirup, and rendering it ready for use again. As soon as the lower part of the retort has become red hot, the slide in the bed-plate is drawn, and as the red hot contents fall out the coal from above settles down, and more is added—the cover being replaced as at first; so the process is continued until all is reburned. The red hot coal from the retorts is sprinkled with water in quantity barely sufficient to quench it and prevent it burning away. Some people say that the coal should be washed before being again used; but I am satisfied that this is a mistake. No water, save that mentioned to quench it, should be added until after the sirup has been run through.

The waste for each reburning is generally estimated at ten or fifteen per cent.

SUGAR MAKING.

Upon this subject much might be written, as indeed much has already been written; but as in this essay the aim is *practical*, I shall content myself with stating briefly what I have seen and done in this respect, and indicating the direction in which I conceive success to be attained should be sought. Experiment has conclusively proven that crystallizable *cane* sugar exists in the juice of the *sorghum*. Moreover, sugar of fair quality has repeatedly been exhibited in various parts of the country, purporting, and truly so I doubt not, to be the product of the *sorghum*. But the question as to whether or not sugar can be produced from the sorghum, at a cost which will enable it to stand in the markets on an equal footing with Orleans and other sugars, has not yet been solved to the satisfaction of the public. I say, *to the public*, for I myself have no doubts on the subject, and in this I am not at all singular.

To descend to the facts of the case, I have found in my experiments on sugar making that the juices of mature cane, when properly handled, would produce perfect crystals of cane sugar. Although during the past season no especial arrangements for sugar making were prepared in my works, I reduced two small batches to what I considered a proper consistence for crystallization, and in both cases granulation commenced within two hours after removal from the pan, and in two days the whole was filled throughout with large-sized rhombic crystals. These results were especially gratifying, inasmuch as I know of few instances, if any, where crystallization commenced before three or four days after concentration; and the best specimen of sugar which I have yet seen, with the exception of some made by Mr. Lovring, of Philadelphia, was on exhibition at the Ohio State Fair, September, 1861. This was procured from a barrel of sirup made the previous season, and kept over until the summer ensuing; at which time, but not before, it began to crystallize.

Now it appears to me that the manufacture of sugar can scarcely be conducted with profit unless the granulation is complete and the purging can proceed within the space of, say, six days.

During the past season, the spring proving so wet, and the long dry spell following so retarded the cane as to give a poor chance for the maturation of the juice; indeed, had the frosts not held off pretty late, I question if the crop would have been worth working up at all. The cane, the juice of which I used in the experiments quoted above, was imphee of only medium quality, the juice marking 7° Baumé; and in one case I used the whole length, but in the other

the butt only. The latter quantity would undoubtedly have turned out most favorably had not an accident caused the whole batch to be spoiled. The former quantity I kept some days, but, having no place wherein the due temperature for granulation could be kept up, I returned it to the pan and re-dissolved it into sirup; probably, too, it was boiled too high, standing 44° Baumé, and showing a temperature of 233° Fahrenheit. The molasses which drained from it was dark and empyreumatic in flavor. Better attention to the cultivation and seasons favorable to the maturation of the cane, resulting in a juice marking 10° Baumé, together with well-arranged purging-houses, where a temperature of 90° Fahrenheit may be kept up night and day, will, I am sure, result in a fair yield of good sugar.

For the guidance of those intending to experiment in sugar making, the following brief sketch of the Louisiana sugar-house may be of use as indicating the kind of arrangements necessary to be made. In addition to the buildings already described, there is a large room into which the cooling or granulating vats are conveyed from the boiling-house on a tram-way. The vats are about six feet long, two feet wide, and one foot deep, and the room into which they are conveyed is kept warm. Here they remain until granulation is completed, when hogsheads are brought on trucks and filled with the sugar; thence, the hogsheads filled with the moist sugar are wheeled off to the "purgery." The purgery is a building equally spacious as the granulating room, and is open-floored, with strong timbers set at such distances apart as to receive the hogsheads on two of them. The molasses, as it drains from the hogsheads, runs on to the earthen floor below the timbers, and is conveyed by falls to a large cement cistern in one part of the ground. Often the purgery is large enough to contain two and three hundred hogsheads.

In our colder northern climate both the granulating and purging rooms will require to be closed in, so as to secure an equable temperature throughout the working season in all the changes of the weather.

CONCLUDING REMARKS, STATISTICS, ETC.

The desire to be self-sustaining is natural to every community, and in this desire the States north of the Ohio are making efforts to perfect the culture of sugar; which efforts, anxiously watched, are likely to be crowned with success. During the past season, the sale of ordinary molasses and sirups has been reduced in most of the cities north and west about sixty per cent., simply by the supply of sorghum sirups which have been thrown upon the market.

It is difficult to arrive at a true estimate of the aggregate production of this article in the past year; it is safe, however, to estimate the number of iron mills used to be about three thousand, and of wooden ones a nearly equal number. A fair average product from each mill may be stated at twenty barrels, which will make 120,000 barrels of forty gallons each; which, estimated at $20 per barrel, makes a total of $2,400,000! Much larger estimates are made by others, but it is *safe* to assume thus much. For next season, we may safely multiply these figures by four, as there will be quite as large an increase in the number of acres planted.

In the rural districts I find the sirup used not only for the table and for cooking, but also for sweetening tea and coffee; and here it may not be amiss to suggest that it may be used with advantage and economy in curing meat, especially beef and pork hams. The best way to proceed in this is to cut the meat ready for packing, and cover it in the cask with a brine as strong as possible. After remaining in this brine twenty-four hours they may be taken out, or the brine poured off into a boiler. To the brine add four ounces of saltpetre and four gallons of sirup; stir it well and boil. The blood from the meat will thoroughly defecate the pickle, and the scum will rise to the surface, when,

being removed, the brine will be left pure and bright as amber. It should then be allowed to cool, and afterwards returned to the meat, and in twenty days the meat will be ready for cooking or smoking. Care should be taken to use non-acid sirup for this purpose, as otherwise the meat might be injured.

Thus I have fully, and as methodically as the time at my disposal would permit, given the results of my experience in this matter up to the present time, and here leave the subject with the public, who, I doubt not, will in due time succeed in placing *sorghum culture* and *sugar making* among the staple productions and manufactures of the north.

THE CULTURE AND MANUFACTURE OF SUGAR FROM SORGHUM.

BY D. M. COOK, MANSFIELD, OHIO.

SOIL AND CULTIVATION.

SELECT either a lime soil, or supply it with a moderate amount of lime. Lime neutralizes the acids in the canes. A sunny exposure is preferred.

Plough deep in the fall, and, if the soil is poor, turn in plenty of straw manure. Stir in the spring, and reduce the ground to the finest tilth.

As soon as the ground is sufficiently warm and dry in the spring put in the seed, from half an inch to an inch in depth, drilling it in rows about three and a half feet apart, and secure a good stand of cane every twenty inches. Many think time is gained by sprouting the seed, which may be done by pouring hot water upon the seed in a basket, and allowing it to stand by the stove a few hours. The object of "sprouting" is to crack the hull, and care must be taken not to let the sprout shoot forth too far before planting, as it is easily broken off, and the seed lost.

Stir the ground freely from the time you can see the cane until it is about three feet high. Let no weeds be tolerated.

I never pull off the suckers, but many think they gain by so doing. If the season is sufficiently long for the suckers to mature, I think more sugar and sirup will be made to the acre not to pull them off.

I have seen transplanting tried with good effect, the canes being much larger than those which were unmoved, and did not tiller out so much.

HARVESTING.

Let the cane fully ripen, if possible. If frost is apprehended it may be cut up when the upper half of the panicle is black, banded in small bundles, and shocked for a few days in the barn or under a shed. On no account should it be left exposed to sun or rain. Curing it in this way arrests the tendency to re-acidulation and second growth, and allows time for the culmination of the juice to its greatest percentage of sugar. If the cane is fully ripe it may be worked into sirup and sugar with advantage as fast as it is cut up; but if the juice is not perfectly matured it should be allowed to "season" a few days.

Dry fall weather causes a more perfect culmination of the juice than warm and wet weather. In the latter the disposition to germinate is so great that the cane scarcely matures before re-acidulation commences as the first stage for sending forth new shoots at the upper joints.

In securing this culmination of the juice and preventing re-acidulation lies one of the great fundamental means of success in the manufacture of sugar from any variety of cane, being difficult of attainment, (more particularly in the African cane,) owing to the disposition in the canes not to mature at the same time.

MANUFACTURING.

Having secured the cane at its best stage, the next question is the best mode of manufacturing. An iron mill, with at least three rollers, should be used, as the wooden mills (which answered well for our primitive experiments) lose one-half of their juice. The cane should be stripped, topped, and, for *very nice* experiments, should be cut in the middle, the butts pressed and evaporated by themselves for sugar, and the tops for sirup. In my experiments in 1861 I used the whole stalk with complete success.

Of the most vital importance is the mode of defecation and evaporation. To boil the juice in the ordinary kettles or pans is to waste both your time and your crop, as has been fully demonstrated by the thousands of experiments heretofore made.

Defecation and evaporation must be combined in one action; that is, during evaporation there must be a constant defecation. The albuminous matter will not coagulate except upon the application of an active heat, and as this matter and other impurities rising in the scum cannot rest upon a boiling surface without being again plunged by the currents into the juice, and, finally, so incorporated with the sirup as to prevent granulation, it is clear that the evaporator must afford a means of retiring this scum from the boiling surface as rapidly as it arises. Hence there must be a cool surface within the pan outside the line of ebullition, where it may rest. This cooling surface is indispensable, and no one has succeeded in making sorgho sugar who did not use it. I therefore made a pan with the sides projecting over the surface several inches.

In my first experiments I used lime in defecation, but finding that a simple *active heat* was the best defecator, I abandoned it. To secure the best effect in defecating by heat, and also the most rapid evaporation possible, which is another great requisite to success, the juice should be boiled in shallow bodies. In doing so I found great danger of burning, and, therefore, introduced a running stream of juice into my pan; but as the scum collecting at the cool sides of my pan would pass down the whole length of it, and mingle with the sirup as it flowed out into my coolers, I constructed ledges starting out from each side alternately, and reaching nearly across the pan, thus giving me a zigzag current from one end to the other. These ledges held the scum at the cool sides until removed by the skimmer. They also accomplished another important and very unexpected result, which I will endeavor to explain:

Different degrees of heat cause different kinds of impurities to rise to the surface. At the front end of my pan one kind came up, while further down, being hotter, another kind, and so on, until about half way down my pan I found all the green impurities removed, and nothing left but the "cane gum," as it is frequently termed; this is precipitated, and forms a white coat upon the pan for the space of about three or four channels. This coat must be removed from the pan while soft with a stiff broom, as it becomes almost as hard as steel, and is then difficult to remove. After this "gum" is removed the sirup is free to crystallize, and to this principally I attribute my success.

Another thing I found essential. The sirup must be hurried to the point of crystallization as rapidly as possible, and when it is attained be instantly removed from the evaporator. That point is about 228° Fahrenheit, and testing the sirup by weight it should weigh from eleven to twelve pounds to the gallon. Eleven pounds does very well, but crystallization is rather slow. The bubbles

afford a good index of the proper stage, the same signs used in boiling maple being applicable to sorghum.

In order to cause my running stream always to reach the outlet of the pan just at the point of crystallization, I placed it upon rockers, and could thus hasten or retard the stream as my fire might require. I am thus enabled to have a constant stream of juice flowing into the pan, and a stream of sirup as constantly from it. This device secured for me the grand requisites, thorough defecation and rapid evaporation. A patent for it has been granted me.

It has been a question what kind of metal should be used in evaporators. Galvanized iron has been very extensively used through the west, and is highly valued by many. The objection to it is, the galvanized coating is liable to scale off. It is also affected by the acids in the juice, so that sirups made upon it have a saltish taste. Russia iron is highly esteemed and for a cheap article is, perhaps, as good material as can be used, but the best yet tried is good heavy sheet copper. True, this is expensive; but this is more than balanced by its durability and the ease with which it is cleansed.

If any object to the use of sheet metal on account of its lightness, I would say that it is more durable and economical than cast iron. The latter often *cracks* just at the time you can least afford to stop your work. It also rusts out very rapidly—more so than Russia—and galvanized iron is cumbersome, difficult to handle, and, moreover, is very expensive.

In addition to a mill and an evaporator, which will accomplish the above results, there are needed several shallow wooden coolers and a V-shaped draining box with slide-covered openings in the bottom. The mill may be set upon a bank and a pipe lead from it to the evaporator below.

The sirup should not be raised above 228° or 230° Fahrenheit. If made too thick, the atoms of sugar are not free to move about and assume the crystalline form. Neither should the sirup be allowed to get cold. The coolers should be set away in a warm room, at a temperature of about 90°, and that temperature should be maintained day and night until crystallization is perfected. In our climate artificial heat is, of course, required, and *our farmers cannot expect success unless they are willing to go to this trouble.* My sirup crystallized in 24 hours, and in a very few days crystallization and drainage was complete.

DRAINAGE.

When the sirup has thoroughly crystallized, shovel the sugar into the draining box, open the slides and allow the molasses to drain out. A quicker process is one I this fall adopted for the first. I made a strong linen sack, put the crystallized mass into it and placed it under a press as I would a cheese. An hour's pressure is sufficient to bring out the sugar dry. I look upon this as the better way of the two, and a very large amount can thus be drained in a short time.

HYBRIDIZATION.

Great care should be taken in the selection of seed. Our sorghum has been grown so indiscriminately with broom-corn and other members of the millet family, that it has become to a great extent hybridized. Know the history of your seed before you plant it.

"THE SORGHUM TASTE"

will not be found in well grained sugar, as it all drains out with the molasses. The sugar is of fine flavor, surpassing the New Orleans and nearly equal to maple.

In the sirup the "sorghum taste" may be removed by treating the juice with

milk of lime or whitewash before boiling. The proper quantity may be known by testing with litmus paper. With too little lime the blue litmus is changed to a red, and with too much that red is changed back again.

VALUE OF THE CROP.

The expense of cultivating and manufacturing an acre of sorghum is about $37. It may run, possibly, to $45 or $50. My cane yielded about 225 gallons to the acre, and of this about seven pounds to the gallon were crystallizable sugar, giving 1,575 pounds to the acre.

Mr. J. H. Smith, of Quincy, Illinois, made 1,500 pounds to the acre from the crop of 1861, and had 115 gallons of good sirup beside. Brown sugar is now retailing throughout the west at 12½ cents, and wholesale at 10 cents per pound. Molasses sells readily at wholesale at 40 cents. The profits may therefore be stated as follows:

1,500 pounds sugar, 10 cents per pound	$150 00
115 gallons molasses, 40 cents per gallon	46 00
	196 00
Deduct expenses, say	50 00
Balance, net profit	146 00

I look upon the day as near at hand when the north will raise sugar for export. All that is wanted is for the farmers to give the sorgho crop the same care and attention they would any other. So long, however, as they are satisfied to make sirups in the most negligent manner and in common pans and kettles, and so long as they take less care of it after it is made than they would vinegar, they must be content with miserable wild-tasting sorghum molasses, leaving the *sugar* for their more enterprising neighbors.

NOTES ON THE RECENT PROGRESS OF AGRICULTURAL SCIENCE.

BY DAVID A. WELLS, TROY, NEW YORK.

NOVEL PRIZES FOR HORTICULTURAL SOCIETIES.

The London Horticultural Society, with a view of encouraging the cultivation of plants and flowers among the humble classes, and thereby indirectly promoting their moral improvement, have, in their recent exhibitions, offered and awarded prizes for the finest plants and flowers raised by children in the ragged schools, and by persons in domestic service. This plan, although but recently introduced, has proved very effective in extending the cultivation of plants and flowers among children, and will, undoubtedly, greatly add to the comfort and beauty of many humble homes.

A recent exhibition in London brought out plants grown in windows in some of the most miserable parts of St. Giles's, and the arrangements made placed those in the worst conditions on a comparative equality with each other; and

although many of the flowers showed the blackened appearance which might be expected in such localities, the exhibition had an interest to gardeners and others. It brought out the ingenuity of the young aspirants to horticultural honors; one produced a young chestnut tree, another an oak, a third a walnut tree, another an orange tree—all from their several nuts, pips, or seeds, for prizes are offered for things not in bloom, and therefore nothing was excluded.

The culture of flowers and plants must have a humanizing effect, and may be, in many instances, the means of producing some very desirable results.

GREAT TRIAL OF STEAM PLOUGHS.

An extensive trial of steam ploughs, lasting twelve days, has recently been made at Leeds, England, and the Mark Lane Express gives an elaborate report of the experiments. Most of the work was done by engines stationed at the side of the field and drawing the ploughs across by long ropes; though it seems there were at last two engines that travelled over the ground. The Express concludes that the latter system is impracticable, but concludes that ploughing on the long rope plan may be introduced on very heavy clay soils as a partial substitute for horses.

The engines cost from $2,500 to $4,000 apiece, and the cost of the ploughing ranged from $1 38 to $2 10 per acre. The fastest work was at the rate of three-fourths of an acre per hour, and the shortest at the rate of an acre in two hours and a half. The Express comes to the conclusion that steam cannot be used profitably in ploughing any land that can be ploughed by two horses at the rate of one and a half acre per day.

STEAM CULTIVATION—DEEP PLOUGHING.

At the late meeting of the Royal Agricultural Society at Leeds, England, Professor Wilson, of Edinburgh, delivered a lecture on steam power as a substitute for horses, in which he presented new and important views on the subject. He stated that for light soils and shallow ploughing the advantages were, perhaps, on the side of horses, but on heavy soils and for thorough cultivation, the steam plough possessed superior advantages, and far heavier crops would undoubtedly be attained in Great Britain when ploughing by steam became more general. There was a limit to the depth of ploughing by horses, but with a steam plough, having an engine of ten or perhaps twenty horse power, the depth desired could be reached, and thus thorough subsoil ploughing could be executed continually. In heavy soils the steam plough could run furrows twelve and fifteen inches deep, thus turning in the top soil and bringing up the indurated subsoil to the surface to be exposed to the air and the moisture, and thus become fitted for yielding large crops. Professor Wilson stated that all soils intended for crops should be ploughed in the fall before severe frost and cold weather set in. He said, "An autumn day's dry tillage, when the temperature of the earth and atmosphere is high, is of far more value than a week's ploughing after the cold and rains of winter." The steam plough affords facilities for cultivating a great space of land in a short period of time, so that every advantage can be taken of dry weather in using it to prepare the soil in due season.

ON THE EXHAUSTION OF SOILS.

At the last meeting of the British Association, (September, 1861,) the following paper on the "Exhaustion of Soil," was presented by the well-known agriculturists, Messrs. Lane and Gilbert:

The question of the exhaustion of soils is one of peculiar interest at the present time, not only on account of the great attention now paid to the waste of manuring matters discharged into our rivers in the form of town sewage, but

also from the fact that Baron Liebig has recently maintained that our soils were suffering progressive exhaustion from this cause, and predicts certain, though it may be distant, ruin to the nation, if our modes of procedure be persevered in. The question was one of chemical facts, and the authors had it in view to treat it much more comprehensively than they were enabled to do on the present occasion. They proposed, by way of illustration, to bring forward one special case of progressive exhaustion, occurring in the course of their own investigations, and then to contrast the conditions of that result with those of ordinary agriculture. They had grown wheat for eighteen years consecutively on the same land, both without manure and with different constituents of manure, and they had determined the amounts of the different mineral constituents taken off from each plat. Numerous tables of the results were exhibited. The variation in the composition of the ash of both grain and straw, dependent on variation of season, was first pointed out. Reverting to the main subject of inquiry, it appeared that, when ammoniacal salts were used alone, year after year on the same land, the composition of the ash of both grain and straw showed an appreciable decline in the amount of phosphoric acid, and that of the straw a considerable reduction in the percentage of silica. The average yield of mineral constituents was very much increased by the use of ammoniacal salts—much more so than when a liberal supply of mineral constituents alone was used. But in neither of these cases was there anything like the yield of mineral constituents that was obtained when the ammoniacal salts and mineral manures were used together, or when farm-yard manure was employed. The greatest deficiency indicated was in the silica and the phosphoric acid; and next in order came potash and magnesia. The exhaustion here apparent was, however, not to be wondered at, when it was considered that in these experiments, in which both corn and straw had been annually removed, without the usual periodical returns of farm-yard manure, there had been taken from the land, by the use of ammoniacal salts alone for sixteen years, as much silica as would require four hundred years, and as much phosphoric acid as would require thirty-two years, and as much potash as would require eighty-two years of ordinary rotation with home manuring, and selling only corn and meat, to remove.

Again: in the experiments of the Rev. Mr. Smith, of Lais, Weedon; on the growth of wheat year after year on the same land, the authors estimated that he annually took from each acre about seven times as much potash, about three and a half times as much phosphoric acid, and about thirty-seven times as much silica, as the ordinary course of practice would do; and yet, after some fifteen years, his crops were said to be not at all failing. The authors did not recommend such practice as that quoted, either from their own or Mr. Smith's experiments; but the instances given showed the capabilities of certain soils, and in one case the conditions under which the point of comparative exhaustion had been reached. It was, of course, impossible to state the limits of the capability of soils generally, so infinitely varied was their composition; but it would be useful to give an illustration on this point. Taking the average of forty-two analyses of fourteen soils, of very various descriptions, it was estimated that it would require, of ordinary rotation with home manuring, and selling only corn and meat, about two thousand years to exhaust the potash, about one thousand years to exhaust the phosphoric acid, and about six thousand years to exhaust the silica, found to be soluble in dilute hydrochloric acid, reckoning the soil to be one foot deep. Many soils, doubtless, had a composition inferior to that here supposed. In a large proportion, however, the amounts of the constituents assumed to be soluble in dilute acid would probably be available for plants before the expiration of the periods mentioned, while in a large proportion there would still be further stores eventually available within a greater or less depth from the surface. But in practice the exhaustion was really by no means so great as supposed in the above illustration. Where there was no im-

port of cattle food, or artificial, as town, manures, the sale of mineral constituents in corn and meat would be much less than were taken in the authors' estimates. Those amounts of exports from the farm could only be reached when cattle food or direct manures were purchased by the farmer; and wherever the courses were pursued judiciously there was always much more phosphoric acid (the most easily exhausted constituent) brought upon the land than could be exported in the increase of produce obtained. In such cases, in many soils, potash was more likely to become deficient. Then, again, a not inconsiderable portion of the refuse of our towns was derived from imported food, or other matters not obtained from our own cultivated land, while by no means the whole of it reached the sewers and thence the rivers.

In conclusion: While the authors believed that modern practices did not tend to exhaustion in anything like the degree that had been supposed by some, they would, nevertheless, insist upon the importance of applying to agricultural purposes as much as possible of the valuable manuring matters of our towns. It was at the same time certain that if these were to be diluted with water in the degree recognized under the present system, they could then, unless in exceptional cases, be only applicable on the large scale to grass land, and, so far as this was the case, they would, of course, not directly contribute to the restoration to the land under tillage of the mineral constituents sent from it, in its produce of corn and meat.

HORTICULTURE IN JAPAN.

Mr. Veitch, jr., son of the eminent London nurseryman, is now in Japan investigating the condition and method of horticulture in that country, with a view to the selection of novelties, &c. In a recent letter to the *Gardener's Chronicle* he states that the Japanese possess great horticultural skill, and far exceed the Chinese in this respect. The Japanese nurseries are very numerous and extensive, presenting many varieties of trees, shrubs, and flowers. He says: "Chrysanthemums are especial favorites with the Japanese, and at this season of the year are everywhere in full bloom; scarcely a window in the town (Yeddo) but has a plant or two, and each establishment devotes a piece of ground to their culture. They are grown to great perfection, and many varieties (exclusive of the ordinary large flowering ones) are met with. The fan-shape is the favorite mode of training them; their finest specimens averaging three and a half to four feet in height, and often having from twenty-five to thirty expanded trusses of flowers on them. The great characteristic mark of a Japanese nursery is its peculiar neatness, everything clean and in order, not a weed or a pot out of place to be seen." Their mode of pot culture seems to consist, first, in confining the roots of their plants in as small pots as possible; second, in using a light open soil, generally the same for all classes of plants; third, supply them with unlimited quantities of manure-water. Their success in dwarfing trees is mainly to be attributed to the last named cause. The soil acts merely as a means of protecting the roots from the sun and air. It is the manure-water which nourishes the plant and keeps it in a growing state.

Mr. Veitch found a new tree (fern) in the garden of the great temple of Osakusa, which thrives well in the open ground, and will, he thinks, prove hardy in England. Again he says: "The quantity and splendor of the timber trees in the neighborhood of Yeddo far exceed anything that can be described." Mr. Veitch took measurements, finding pines three feet from the ground, with a circumference of ten feet; beech, fifteen to twenty feet; spruce, (very common,) ten to twelve feet; evergreen oak, fifteen to twenty-five feet; ginko, fifteen to twenty-eight feet; and cryptomeria, (tens of thousands of them,) twelve to fifteen feet.

FRUIT PRINTING.

The *Agrowomische Zeitung*, a German journal, publishes the following: "At Vienna, for some time past, fruit dealers have sold peaches, pears, apples, apricots, &c., ornamented with armorial bearings, designs, initials, names, &c. The impression of these things is effected in a very simple manner; a fine fruit is selected at the moment it is beginning to ripen, that is, to take a red color, and paper, in which the designs are neatly cut out, is affixed. After a while the envelope is removed, and the part of the fruit which has been covered is brilliantly white."

THE WINTER GARDEN AT KEW, ENGLAND.

The glass structures for the cultivation of exotic plants and trees, heretofore erected at the royal botanical gardens at Kew, England, although far exceeding those of any other establishment of a like kind, have nevertheless been found quite insufficient to meet the multifarious requirements of the rapidly increasing collections of plants brought from all parts of the world, and more especially for the full development of those of great magnitude. The English government has therefore granted the sum of £10,000 for the erection of a new conservatory or winter garden. The ground plan of this building consists of a centre 212 feet 6 inches long, and 137 feet 6 inches in breadth, and 60 feet in height to the ridge of the roof. Each of the two wings is 112 feet 6 inches long, 62 feet 6 inches in width, and 37 feet 6 inches high in the centre. The two connecting octagons are 50 feet in diameter; the whole length is 582 feet, and its superficial contents 48,392 feet, or about $1\frac{2}{3}$ acres. The heating will be effected by four lines of hot water pipes, placed under the plant tables, round the sides of the house; and the temperature desired will only be about 40° during winter, to exclude frost and damp from the centre and wings. The octagons, however, will be kept at a tropical temperature. The boilers are of a novel form, and patented by the builders, Messrs. Cubitt & Co. They are placed in vaults under the floor of the octagons, and by this means they can be heated apart from, or together with, the rest of the building, as circumstances may require.

The centre part will contain about 12,000 lineal feet of hot water pipes; the wings 6,000 lineal feet, and the octagons 2,100 lineal feet, or collectively, 22,100 lineal feet, or upwards of $3\frac{3}{4}$ miles. The glass employed will be green tinted, and will require about 63,848 superficial feet. It is proposed that the floor, excepting that of the octagons, which will be paved, should be of gravel, and on this the plants will be set or plunged in. Four capacious tanks, capable of containing collectively 130,000 gallons of water, are placed under the terrace, and the supply will be drawn from them by pumps set at convenient places through the structure.

In construction certain ingenious novelties occur, particularly in the ventilation. All the vertical sashes are hung on centres, and are to be opened and shut by hand from the ground floor or gallery, in the usual way. The roof is constructed of straight rafters, instead of curvilinear ones, for the convenience of removing the sashes, which are acted upon in a very complete manner by a mechanical apparatus, contrived by the engineer of the contractors. In the roof of the centre part the roof sashes are in four tiers of lights, the three upper ones being made to slide down on the lower one, thus throwing the greater part of the roof open for the trees and plants during the summer. The mechanism employed for this purpose is that of the wheel and endless screw, worked at the level of the gallery, which runs round the centre house, and is of such power that a man can cover or uncover each bay of five hundred superficial feet in about five minutes.

RIBBON FLOWER BED.

The authorities at the Kew (National) Gardens arranged during the past year the various flowers at their disposal in the form of a "ribbon flower-bed," fifty feet in length by seven in breadth. The effect of this arrangement was exceedingly brilliant, and has been very happily turned to a practical account, inasmuch as all the great centres of English industry have sent agents and artists to copy it, as designs and patterns for the goods they manufacture, viz: Manchester, prints, chintz, draperies, &c.; Coventry, ribbons; Kidderminster, carpets; Glasgow, muslins, shawls, &c.; Yorkshire, colored table-covers; Belfast, damask table-linen, &c.; Nottingham, lace; Macclesfield, Derby, and Spitalfields, silks, embroideries, &c.; Dublin, mixed fabrics; Paisley, Scotch goods and window muslins; Bradford, moreens and damasks; Clerkenwell, artificial flowers; and the potteries, china and porcelain. One lady ordered to be manufactured for her fifty yards of stair-carpeting and a drawing-room carpet, the borders and centres of which are to be an exact imitation of the borders and centres of the flower-bed in question.

CHEAP CISTERNS AND FILTERS.

The following information on this important topic, taken from the American Farmer, is contributed by John Milkinson, landscape gardener and rural architect, and will be found very useful for farmers:

A cistern of the dimensions that I shall describe will hold one thousand gallons, will cost but eight dollars, and its capacity may be doubled for less than fifty per cent. additional cost. One of this size will be found sufficient for farmers' families generally, and will insure soft water, which is rare in wells. The following are the directions for excavating cisterns: Stake and line out a plat near the building eight by ten feet, excavate this one foot in depth, then set the lines in eighteen inches on all sides, then excavate all within the lines, or five by seven feet, to the depth of fourteen feet in the middle, making the middle level some nine inches in width, sloping the banks on all the sides and ends to the lines last placed, which will make a section of the pit either way V-shaped, except that nine inches of the bottom will be level. In digging the banks use care not to disturb the soil not thrown out. When the digging is completed plaster the bottom, the level part, with a good coat of cement mortar, and place a board on it to stand on to do the balance of the work, cutting the board in two equal parts before laying it on the mortar. This done, plaster the entire surface on the ground to the lines last named, then remove one-half of the board and stand on the balance, and build a four-inch brick wall across the pit, about in the middle, laying the bricks, which should be *soft*, (common salmon brick,) in cement, but plastering neither side. Lay the wall to the line, then remove the balance of the board and put a coat of mortar where it lay. The cistern is now complete, save the covering; this may be done by laying plank over the whole bedding, then on the surface of the first excavation in mortar, or splitting logs from the woods and laying them flat side down, and closing the joints with mortar. The pump pipe should be laid into one end, and the leader pipe from the house-gutter laid into the other before it is covered. This done, return earth enough to cover the surface at least one foot deeper in the middle than the surrounding ground; level it off neatly and sward it, and you have a complete filtering cistern for eight to twelve years.

IMPORTANT USE OF SEA-WEED.

M. E. Legon has presented a report to the Paris Academy of Sciences on the employment of sea-weed, applied in layers against the thin walls of habitations,

to prevent sudden variations in, and excess of temperature. The marine algæ, such as seawrack, may be termed a sea-wool, which has this advantage over ordinary wool, that it does not harbor insects, and undergoes no change by dryness or humidity, provided it be not exposed to the solar rays; in that case it undergoes a complete transformation—from being brown and flexible it becomes white and almost rigid. In the dark, on the contrary, it is unchangeable, unfermentable, imputrescent, uninflammable, and unattackable by insects. At first it has the objection of being hygromatic; but a single washing in fresh water removes the salt, and then its properties become so beneficial that a celebrated architect has styled it the "flannel of health for habitations." It has been applied successfully between the tiles and ceiling of a railway station; also in a portable house intended for the use of officers at the camp of Chalons; also double panels, the intermediate space being filled with sea-weed, have been provided for the construction of temporary barracks at the Isle of Réunion. The Consulting Committee of Public Health, the Society of Civil Engineers, the Council for Civic Structures, &c., have expressed their approval of the judicious employment of the marine algæ, and state that the popularization of this process will be of great service in dwellings, especially in those of the humbler class, as it renders them both agreeable and salubrious.

ADMINISTERING MEDICINE TO HORSES.

George Beaver writes thus to the American Agriculturist: "I consider the usual method of giving medicine to horses by drenching, as it is called, highly objectionable. In this process, the horse's head is raised and held up, a bottle introduced into his mouth, his tongue pulled out, and the liquid poured down. In his struggle some of the medicine is quite likely to be drawn into his windpipe and lungs, and inflamation and fatal results sometimes follow. A better way is, to mix the medicine with meal, or rye bran—make it into balls, pull out the horse's tongue, and place a ball as far back in his mouth as possible, then release his tongue and he will almost certainly swallow the ball. Or, the dose may be mixed with meal and honey, or any other substance that will form a kind of jelly, placed upon a small wooden blade made of a shingle and thrust into the back part of his mouth, when he will very easily swallow it."

THE FEEDING OF HORSES.

The London Omnibus Company have lately made a report on the feeding of horses, which discloses some interesting information not only to farmers but to every owner of a horse. As a great number of horses are now used in the army for cavalry, artillery, and draught purposes, the facts stated are of great value at the present time.

The London company uses no less than 6,000 horses; 3,000 of these had for their feed bruised oats and cut hay and straw, and the other 3,000 got whole oats and hay. The allowance accorded to the first was: bruised oats, 16 pounds; cut hay, 7½ pounds; cut straw, 2⅛ pounds. The allowance accorded to the second: unbruised oats, 19 pounds; uncut hay, 13 pounds. The bruised oats, cut hay, and straw, amounted to 26 pounds, and the unbruised oats, &c., to 32 pounds. The horse which had bruised oats, with cut hay and straw, and consumed 26 pounds per day, could do the same work as well and was kept in as good condition as the horse which received 32 pounds per day. Here was a saving of 6 pounds per day on the feeding of each horse receiving bruised oats, cut hay, and cut straw. The advantage of bruised oats and cut hay and straw over unbruised oats and uncut hay and straw is estimated at five cents a day on each horse, amounting to $300 per day for the company's 6,000 horses. It is by no means an unimportant result with which this experiment has supplied us. To the farmer who expends a large sum in the support of horse power, there

are two points this experiment clearly establishes which in practice must be profitable: first, the saving of food to the amount of six pounds per day; and the second, no loss of horse power arising from that saving.

SALT WITH MANURE.

Dissolve common salt in water, sprinkle the same over your manure heap, and the volatile parts of the ammonia will become fixed salts, from their having united with the muriatic acid of the common salt, and the soda thus liberated from the salt will quickly absorb carbonic acid, forming carbonate of soda; thus you will retain with your manure the ammonia that would otherwise fly away, and you have also a new and important agent introduced, viz: the carbonate of soda, which is a powerful solvent of all vegetable fibre.

RUNAWAY HORSES—A NEW CHECK.

A great many patents have been taken out of late years for stopping runaway horses; and in almost every saddler's shop we see engravings of apparatus devised to squeeze a horse's throat or nose, or to catch up one leg and throw him down. But to all this machinery it is objected that if a horse is really running away at a great pace, he cannot be stopped suddenly by violent means without considerable risk both to man and beast. A very ingenious invention, operating upon the horse's movements by moral force alone, has been recently brought out by M. Lévéque, a French officer of the cavalry school of Saumur.

His plan will assuredly not be approved of by those who object altogether to the use of blinkers, for it is but an extension of the blinker system. The partisans of blinkers, however, for horses in harness are, up to the present time, in an enormous majority.

The leading idea of M. Lévéque's invention is to induce the horse, by his own natural instincts, and without any mechanical force, to hold his head in such a position that the bit shall act properly upon his mouth. Inside of each blinker he places a sort of leather face called a *lunette d'arrét*, which opens or shuts at pleasure by means of a safety rein. When developed it only partially blinds the horse, and it is in the natural action of the horse to avail himself of the sight left him that the virtue of the system consists. If he throws up his head to run away, and the lunette is opened, he can see nothing but the sky, and he then inevitably brings his head down to the proper position, in order that he may see straight before him. If, on the contrary, the habit of the horse be to escape the action of the bit by curving his neck till the chin almost touches his breast, the apparatus may be so adjusted as to prevent him from seeing anything but the ground, and he naturally raises his head. Thus the lunette acts both as a bearing rein and a martingale, but more certainly, and without the dangers and inconveniences of those contrivances. For horses addicted to shying the apparatus is particularly useful. As soon as the horse pricks his ears to shy at any object lying in the road, the driver has only to raise the lunette, and the animal seeing only the distant horizon, and nothing immediately about him, will go by, or even right through, the thing which frightened him, without taking the least notice.

At an exhibition on the *Champs de Mars*, in Paris, horses went unhesitatingly through the flames and smoke of lighted lumps of straw, which, but a moment before, when the lunettes were folded, they could not be made to approach.

The apparatus is intended chiefly for horses in harness, but there is a form of it adapted for saddle horses; of course a hard-mouthed horse cannot unfailingly be prevented from running away surely by the use of this lunette, but a great deal is done towards diminishing the danger when his head is got into a

proper position, because he will then surely be pulled up before long, and in the meanwhile the driver can guide him.

ARTIFICIAL HOOFS FOR HORSES.

It is impossible to calculate the various useful purposes to which gutta-percha may be applied. One of the most ingenious applications recently made of this valuable substance is that of making artificial hoofs for horses' feet. Many ingenious devices have been resorted to to attain this result, but the adoption of gutta-percha will, doubtless, supersede all others as soon as its efficacy becomes recognized. What is required by the veterinary surgeon is a substance possessing the consistence of horn, to retain the nails of the shoe; that will readily soften by heat, so as to mould itself to the required form; that it be indissoluble in water, seeing that the horse's hoof is generally in contact with moisture; and, lastly, that it be capable of uniting perfectly with the hoof. No known substance possesses all these qualities except gutta-percha. For the purpose under consideration, it is prepared by being cut into fragments the size of a nut and softened in hot water; the pieces are then mixed with half their weight of powdered sal ammoniac and melted together in a tinned saucepan over a gentle fire, keeping the mass well stirred; the mixture should assume a chocolate color. When required for use it should be melted in a glue-pot; the surface of the hoof must be scraped clean and the gutta-percha applied as required. The application may be facilitated by the use of a glazier's knife warmed, by which also the surface of the artificial hoof may be smoothed and polished. In this manner many a valuable horse may be rendered useful, which otherwise would only remain fit for slaughter. On the score of humanity, also, this application of gutta-percha is to be welcomed.

INSECT AND GRAIN EATING BIRDS.

Tourists in Europe will, if they are but commonly observant, notice one peculiar feature in continental scenery, and especially in the scenery of France. The landscapes may be beautiful, and diversified by every possible charm, but in one particular respect they will be found almost utterly devoid of life. Eye and ear are struck together by the absence of familiar sights and familiar sounds. There is no chirping in the hedgerows, no twittering among the trees, no congregation of sparrows in the roads, or linnets in the fields. It is useless to look about for the rarer species of birds, as even the commonest sorts are absent, and the traveller is perplexed to think what can have become of all the little creatures which he is accustomed to associate with rural scenes. The truth is very soon told: the French eat them. They pursue them unremittingly for the sake of their morsels of flesh, and a small bird seen in a garden would be chased as eagerly as a rabbit or a hare. Traps are systematically set for them on every eminence, and snares on every hedge. There is an idea, too, that birds destroy fruit, and economists will not submit to any such peculation; but the first is the principal motive, combined, perhaps, with an instinctive passion for the chase, which, in France, admits of little better gratification.

Little birds, however, are not sent into the world for nothing. Under the mission of Providence, they, like all other creatures, contribute their part towards the harmony of creation, and where that contribution is intercepted the effects become visible in a derangement of balance. Birds devour insects, worms, and grubs. Where there are no birds, grubs, worms, and insects multiply to a prodigious extent, and where this unnatural multiplication takes place the crops suffer.

During the past year (1861) the harvests of France have given an unusually poor return, and this deficiency is attributed, in a great degree, to the ravages of sundry insects which it is the function of certain birds to destroy. The

subject has even attracted the attention of the French government, and, at the instance of the minister of agriculture, a commission was appointed to inquire into the matter and report what legislation is expedient.

From a preliminary report emanating from this commission it appears that their inquiries have been conducted with the elaborate accuracy characteristic of the French, and that the most experienced naturalists in France (M. St. Hilaire, M. Provost, &c.) have lent the aid of their experience to these investigations. In them insects and birds have been carefully classified according to their several species; their habits of feeding have been closely observed, and the results ascertained and computed. It has been concluded that by no agency save that of little birds can the ravages of insects be kept down. There are some birds which live exclusively upon insects and grubs, and the quantity which they destroy is enormous. There are others which live partly on grubs and partly on grain, doing some damage, but providing an abundant compensation. A third class, the birds of prey, are excepted from the category of benefactors, and are pronounced—too precipitately, we think—to be noxious, inasmuch as they live mostly upon the smaller birds.

If the arrangements of Nature were left undisturbed, the result would be a wholesome equilibrium of destruction. The birds would kill so many insects that the insects could not kill too many plants. One class is a match for the other. A certain insect was found to lay 2,000 eggs, but a single tomtit was found to eat 200,000 eggs a year. A swallow devours about 543 insects a day, eggs and all. A sparrow's nest in the city of Paris was found to contain 700 pairs of the upper wings of cockchafers, though, of course, in such a place food of other kinds was procurable in abundance. It will easily be seen, therefore, what an excess of insect life is produced when a counterpoise like this is withdrawn; and the statistics collected show clearly to what an extent the balance of Nature has been disturbed. Thus the value of the wheat destroyed in a single season, in one department of the east of France, by the *cicidomigie*, has been estimated at four millions of francs. The French vines, olives, and even the forest trees are also reported as suffering severely from this superabundance of insect vermin; so that, in consequence of the alarm occasioned, birds are likely to be hereafter protected in France without much legislation; and, indeed, their rise in public estimation has been signally rapid. Some philosopher has declared—and the report quotes the saying as a "profound" one—that "the bird can live without man, but man cannot live without the bird."

This is a splendid confession of past error; but what is to be done, seeing that the convictions of philosophers have not yet descended to the peasantry? Are sparrow-catching and birds'-nesting to be made punishable? Must there be a new system of game laws for the protection of sparrows and linnets? The question is really pressing. Yet the commissioners, though they distinctly call for "prompt and energetic remedies," and point to the great detriment which agriculture is receiving, are evidently doubtful as to the course to be pursued. They suggest, however, that persuasion should be tried before coercion, and that schoolmasters and clergy should endeavor to put the question in its proper light before the people.

The commission, in their report, present some curious statistics respecting the extent to which the destruction of birds in France has of late been carried. They state that there are great numbers of professional huntsmen who are accustomed to kill from one hundred to two hundred birds daily; a single child has been known to come home at night with one hundred birds' eggs; and it is also calculated and reported that the number of birds' eggs destroyed annually in France is between 80,000,000 and 100,000,000. The result is, that little birds in that country are actually dying out; some species have already disappeared, while others are rapidly diminishing.

ITALIAN BEES.

During the year 1860 a good deal has been said about the advantage to be derived from the introduction of Italian bees into the United States, and importations have been made for that purpose. The plan is to breed queens, which, being impregnated, are introduced into common hives after removing the old queen.

A writer in the *Country Gentleman* newspaper gives the following as the history of the introduction of Italian bees into this country; he says:

"Mr. P. J. Mahan, of Philadelphia, is mentioned as being the first to land this new variety on our shores; as a matter of history I would state that this is not so. For several years past the attempt has been made yearly by Mr. Richard Colvin, of Baltimore, Samuel Wagoner, of York, Pennsylvania, and the Rev. L. L. Langstroth. These attempts were unsuccessful, owing to bad packing and mismanagement in transportation, until the autumn of 1859, when Mr. Colvin received some Italian stocks, and hoped to have queens from them for sale the past season; but these stocks, unfortunately, did not survive the winter. Next in order of date is Mr. Mahan's importation from Germany, which was successful on account of his personal supervision. Shortly after Mr. Mahan's importation, Mr. S. B. Parsons, of Flushing, Long Island, succeeded in getting a few swarms alive from Italy. From them he has succeeded, aided by several skilful apiarians, in raising a large number of queens, which have been sent to nearly every State in the Union, including California, under the supervision of Mr. Bigelow, a successful apiarian.

"The last successful importation was by Messrs. Colvin and Wagoner. All the above named are exerting themselves to multiply their stock of Italian bees, and they will doubtless have a demand for all the queens and stocks they can supply next season, as the interest in this new bee is deservedly increasing. The question will naturally arise, Of whom shall I purchase? Are these importations equally reliable, and if so, have all taken the same pains and been equally successful in keeping the breed pure? I would here remark, that some situations are more favorable for maintaining purity than others. The Italian bees now in this country are from three different sources, and every one should decide for himself to which stock he should give the preference, and if the most reliable man and the most reliable bee can be found working together.

"Two of the importations are from Germany, and one from Italy. Of the importation from Italy, there can be no reason to question its purity. The two importations from Germany are from different breeders. One of the importations from Germany I have the fullest confidence in, from personal inspection; and if the other be equally good, we are in a fair position to have the country well supplied with pure stock in a few years, provided sufficient interest is taken to maintain its purity."

LENGTH OF LIFE OF THE HONEY BEE.

The following communication is made to the *Country Gentleman and Cultivator* by M. M. Baldridge, of Middleport, New York:

"The majority of persons who have the care of bees entertain the idea that the worker-bees live many years. Their conclusion is drawn from the fact that colonies sometimes inhabit the same domicile for a long period—fifteen or twenty years; never thinking that, as fast as the bees die off, naturally, and from other causes, they are continually replaced by a new progeny. The natural life of the honey bee worker does not exceed six months; and from recent experiments, I believe, does not exceed, in the summer season, three months. By the aid of the Italian or Ligurian bee this may be easily and satisfactorily tested. On

the 2d of July last I gave to a very powerful stock of native bees a pure Italian queen. To-day, September 15, this stock was examined to ascertain what proportion of the bees were of the Italian race. Taking out the frames, one by one, both sides of the comb were carefully inspected, and, so far as I could ascertain, at least nine-tenths of the bees were purely Italian. Also, on the 17th of July I gave an Italian queen to another stock of native bees. This stock was also examined to-day in the presence of a friend who assisted me in the examination. Examining the combs, as before, we did not find in this stock *a single native bee!* This change has taken place, as will be observed, in less than two months. Since the 17th of July I have taken out of this colony combs of maturing Italian broods, giving them to other stock, more than enough to make a good colony of bees. Thus it will be seen that the natural life of the honey bee, in either of these instances, would scarcely exceed three months; also, that it requires only a few months to change an apiary of native bees to those of the Italian race."

EXPORTATION OF BEES TO CALIFORNIA.

Mr. J. S. Harbison, of California, in a volume entitled "*The Theory and Practice of Bee-culture*," (San Francisco, H. H. Bancroft & Co.,) gives the following interesting account of the introduction of bees into California:

"The introduction of the honey bee into California was an important event, and engrossed a large share of public attention; wherefore it is peculiarly appropriate to preserve as full a record of the transaction as possible.

"The following letter from one of the earliest and most successful apiarists of this State contains an authentic account of the introduction of the first bees into California, as well as the success attending their first five years' cultivation in the San José valley:

"'SAN JOSE, *January* 11, 1860.

"'DEAR SIR: Yours of December 26, propounding certain inquiries, has been received.

"'The first bees imported into California was in March, 1853. Mr. Shelton purchased a lot, consisting of twelve swarms, of some person to me unknown, at Aspinwall. The party who left New York became disgusted with the experiment, and returned. All of the hives contained bees when landed in San Francisco, but finally dwindled down to one. They were brought to San José and threw off three swarms the first season. Mr. Shelton was killed soon after his arrival by the explosion of the ill-fated steamer Jenny Lind. In December two of the swarms were sold at auction to settle up his estate, and were bought by Major James W. Patrick at $105 and $110 respectively.

"'Mr. William Buck imported the second lot in November, 1855. He left New York with thirty-six swarms and saved eighteen. I purchased a half interest in them. I also, in the fall of 1854, bought one swarm of Major Patrick, from which I had an increase of two.

"'Mr. Buck returned east immediately and arrived in February, 1856, with forty-two swarms, of which he saved but seven. Our increase in 1856, from twenty-eight swarms, was seventy-three; we also had about 400 pounds of honey in boxes, which we sold at from $1 50 to $2 per pound.

"'Mr. William Briggs, of San José, brought out, spring of 1856, one swarm, from which he had an increase of seven or eight swarms the following summer.

"'The above were the only importations I know of prior to the year (spring) 1857, which covers the ground of your inquiries.

"'There are in our county, at this time, about one thousand swarms.

"'Very respectfully, &c.,

"'F. G. APPLETON.

"'Mr. J. S. HARBISON.'

"The first hive of bees ever in the Sacramento valley was brought from San José in the summer of 1852 by Mr. A. P. Smith, the eminent nurseryman of Sacramento; they, however, soon died, which gave the impression that bees would not do well in this vicinity.

"In this belief I did not concur, and therefore took measures to test the matter further.

"In the fall of 1855 I sent east and had one hive of bees brought out which arrived in Sacramento February 1, 1856. Though most of the bees had died or escaped from the hive during the passage, enough remained to prove that by careful handling they could be imported with little loss, and that they would increase and make large quantities of honey when here.

"I left San Francisco May 5, 1857, on board the steamship Golden Gate, on my way east, for the purpose of preparing a stock of bees for shipping to California.

"Sixty-seven colonies were preparing from my own apiaries, situated in Lawrence county, Pennsylvania.

"They were taken to New York and shipped on board the steamer Northern Light, which sailed from this port November 5, bound for Aspinwall.

"The bees were put on board in good order, were placed on the hurricane deck, kept well shaded and ventilated, and arrived at the latter port on the 15th of the same month, being ten days from port to port. Having arrived at Aspinwall in the forenoon, and ascertained that no passengers or freight would be sent forward before the next morning, I obtained permission to open the hives on the company's grounds, and let the bees fly during that evening, which greatly relieved them, and contributed to their health during the remainder of the voyage.

"The hives were closed up and placed on board the cars, crossed safely to Panama, and reshipped on board the steamer Sonora, which sailed from that port on the evening of the 16th, bound for San Francisco, where she arrived on the evening of the 30th.

"The bees had ample stores within their hives before they were started to last them through their long journey. I neither watered nor gave any additional food during the whole trip, except what they obtained while flying out at Aspinwall.

"During each day's confinement the bees labored incessantly to gain their liberty, but as soon as it was dark they always became quiet, and remained so during the night.

"At San Francisco the bees were transferred from the steamer Sonora to the steamer New World, and landed in Sacramento on the morning of December 2, 1857, thus terminating a journey of 5,900 miles, which was at that time the longest distance that bees had been known to be transported at one continuous voyage.

"On opening the hives I found that considerable numbers of bees had died in each, and that in five all were dead, having been destroyed by worms which had been hatched on entering the warm climate from eggs laid by the moth previous to starting. The combs were entirely enveloped in webs containing the worms, and were a perfect ruin. A few worms were found in each of the hives containing living bees, but were soon exterminated.

"Some hives were found to contain so few bees that they were united with other weak ones, till the number was reduced to fifty.

'In the latter part of January, 1858, I made a discovery which has since been verified in a number of instances. All the bees in two hives swarmed out, leaving them entirely deserted. On examining, I found young broods, the combs were clean and healthy, and each hive contained some six or eight pounds of honey. But it was nearly all sealed up, only a few cells containing honey being open.

"The cause of the desertion was then a mystery, as they had apparently all the requisites to do well.

"I finally suspected that, owing to their long confinement, and frequent passing over the sealed surface of the comb, it had become glazed so that the bees were not aware that they possessed so ample a store.

"Acting from this belief, I at once with a knife uncapped a portion of the honey in each remaining hive; this was repeated twice a week for the following ones,

and as the honey became scarce, feed was given to the most destitute. The result was that no more hives were deserted.

"There was no indication of disease of any kind existing in any of them. Hence there is no doubt of the above being a cause of bees deserting their hives.

"The stock was still further reduced by sale, so that thirty-four hives of bees remained on the first of April. These were increased to one hundred and twenty, most of which were sold in the summer and fall of that year.

"Again, on the steamer of September 20, 1858, I returned east, for the purpose of transporting another stock, which had been prepared for that purpose during the previous summer. On the 6th of December, in company with my brother, W. C. Harbison, I sailed from New York with one hundred and fourteen colonies, and arrived at Sacramento January 1, 1859, with one hundred and three living. Of this importation, sixty-eight were from Centralia, Illinois; the remaining forty-six were from Lawrence county, Pennsylvania.

"Owing to the lateness of the season of shipping, and unfavorable weather during the first three weeks after our arrival, we were only able to save sixty-two out of the whole number; these, together with six good hives remaining from the previous year, we increased to four hundred and twenty-two colonies, including the sixty-eight old ones; three hundred of them filled standard hives, and the remainder averaged half full.

"The increase was all made on the artificial principle. Not a single natural swarm issued from any hive during the whole season. I also formed a large number of colonies, for different parties in Sacramento and vicinity, which were attended with like success.

"During the time between the 1st of October, 1858, and April 1, 1859, there were shipped from New York for California over one thousand hives of bees, not over two hundred of which survived on the 1st of May of the latter year.

"All but three of the parties engaged in shipping them lost money by the operation, many of them being unacquainted with the business.

"Of the modes of importing bees to California, the most novel was that of Mr. J. Gridley, who brought four swarms across the plains from Michigan, placed in the rear end of a spring wagon. He arrived in Sacramento on the 3d of August, 1859, with them, in good condition. His plan was to feed them, and, in addition, stop occasionally in the afternoon and allow the bees to fly out and work till dark, when they were closed up to resume the journey on the following morning. This was repeated from time to time, as they required their liberty.

"Notwithstanding such disastrous results attending the previous years' shipments, there were upwards of six thousand hives of bees imported during the winter of 1859–'60. They arrived in better condition apparently than those of the previous year; yet, owing to the fact that large numbers of them were infected with the disease known as foul brood prior to their purchase and shipment, together with the effects of so long a voyage, probably one-half of the whole number were lost. Many of the remainder have since died, or now linger in a diseased condition, which is infinitely worse for the parties owning them than if all had died at once. Thus the result was bad for all concerned; for, while some have lost their money, others have injured their reputation, besides paralyzing for a time an important branch of productive industry."

SOCIETY FOR THE ACCLIMATIZATION OF ANIMALS.

A society for this purpose, upon a plan similar to that in Paris, has been formed in London. Its objects are:—1st. The introduction, acclimatization, and domestication of all innoxious animals, birds, fishes, insects, and vegetables, whether useful or ornamental. 2d. The perfection, propagation, and *hybridization* of races newly introduced or already domesticated. 3d. The spread of indigenous animals, &c., from parts of the United Kingdom where they are already known

to other localities where they are not known. 4th. The procuration, whether by purchase, gift, or exchange, of animals, &c., from British and foreign countries. 5th. The transmission of animals, &c., from England to her colonies and foreign ports, in exchange for others sent thence to the society. 6th. The holding of periodical meetings, and the publication of reports and transactions, for the purpose of spreading knowledge of acclimatization, and inquiry into the causes of success or failure. The society have begun with small and carefully-conducted experiments. It is proposed that those members who happen to have facilities on their estates for experiments, and who are willing to aid the objects of the society, should undertake the charge of such subjects for experiments as may be offered to them by the society, periodically reporting progress to the council. It will be the endeavor of the society to attempt to acclimatize and cultivate those animals, birds, &c., which will be useful and suitable to the park, the moorland, the plain, the woodland, the farm, and the poultry yard, as well as those which will increase the resources of our sea-shores, rivers, ponds, and gardens.

THE ACCLIMATIZATION OF THE ALPACA AND THE LAMA.

The acclimatization of the alpaca and lama is proceeding vigorously in France. M. Isidore G. St. Hilaire has reported to the French Academy of Sciences the recent arrival of thirty-three alpacas, nine lamas, and one Peruvian sheep, the sole remains of a collection of one hundred head brought from Peru and Bolivia by M. Rocher. The mortality was occasioned by the long and perilous journey by land and sea. M. St. Hilaire said that in less able hands the whole would most probably have perished. In 1765 Buffon recommended the enriching the Alps and Pyrenees with the lama and its congeners, saying, "I think that these animals would be an excellent acquisition for Europe, and would produce more real benefit than all the metals of the New World." In relation to this, M. St. Hilaire refers to the increasing numbers of these animals in France, England Spain, Cuba, and Australia.

PRODUCTIVENESS OF FOWLS.

Experiments to ascertain the comparative productiveness of the different breeds of poultry have been made this spring in the Zoological Gardens of the Bois de Boulogne, Paris. The number of eggs laid by the fowls in that establishment has been immense. It appears that the Asiatic breeds of Nankin and Brahmapootra are the best layers, the French *brèvecauers* come next, the Houdans third, the La Fleche fourth, and after them the Dorkings and a Dutch breed. The Nankins and Brahmapootras are also remarkably precocious, and, according to some breeders, they begin laying in February and keep on almost to the end of the year.

CURING RANCID BUTTER.

A correspondent of the *Rural Register* gives the following recipe for curing rancid butter: For 100 lbs. rancid butter take 2 lbs. fine white powdered sugar, 2 ounces saltpetre finely pulverized, and as much fine dairy salt as you wish to add to the butter to make it to your taste. The butter has to be thoroughly washed in cold water before working in the above ingredients. The amount used should be in proportion to the strongness of the butter.

CHANGES IN EGGS.

Dr. John Davy, of England, in a paper "On the Albumen of the Newly-laid Egg," says: "The albumen of the egg of the common fowl, newly laid, has properties differing in some particulars from those of the albumen of the stale

egg. One of these, and that which is best known, is the milkiness which it exhibits when dressed for the table, provided the egg be not put into water of too high a temperature and kept there unduly long. Another is seen in the manner of coagulating."

Dr. Davy then details experiments at various temperatures, and adds: "These results seem to show that the white of the newly-laid egg is more readily affected by heat of a certain temperature than that of an egg exposed some time to the air, as indicated by the appearance of milkiness it exhibits; and yet that, within a certain range of temperature, the amount of coagulation or the degree of firmness is less.

"That the difference of qualities which I have described is owing to exposure to, and the action of, atmospheric air can hardly be doubted. The proofs seem to be sufficiently clear. The newly-laid egg contains little or no air; and if atmospheric air be excluded, its absorption prevented, as by lubricating the shell with oil or any oleaginous matter, the albumen retains for a considerable time the qualities of the newly-laid egg. This is a fact well known to dealers in eggs.

"The exact time required for the change to take place, owing to the absorption of air, I cannot exactly say. It varies, I believe, in some measure, according to the season—a shorter time in winter being required than in summer; the egg, in the former season, owing to lower atmospheric temperature, contracting more in bulk, as regards its substance, than in the latter. A very few days, as from five to six at furthest, seem to be sufficient. In April I have observed the milkiness in the fourth, but not later. On the contrary, if air be excluded, I do not know how long the quality of the newly-laid egg may not be preserved. I have found an egg laid in the month of April, and then smeared with butter, hardly appreciably changed at the end of six months.

"Nor can I speak with any exactness respecting the amount of air of oxygen absorbed, or of other alterations that may be effected in the composition of the egg by its action. All that I have yet ascertained is that, with the absorption of oxygen in the instance of the stale egg, carbonic acid is formed, and ammonia, and the color of the albumen is darkened, it becoming of a light brownish yellow, and at the same time acquiring a smell somewhat unpleasant, and a taste, as is well known, not agreeable. The putrefactive process, I believe, does not take place, however long the egg may be kept, unless there be some admixture of the yolk and white." Dr. Davy has extended his trials to the eggs of the duck, the turkey, and the guinea-fowl, with similar results.—*Abridged from the Edinburgh Philosophical Journal, No.* 22.

SALT FOR FATTENING SWINE.

A correspondent of the *Annalen des Landwirthschaft* states some interesting experiments to test the use of salt in fattening swine. He selected two pairs of barrow hogs, weighing 200 pounds apiece. One pair received, with their daily allowance of food, two ounces of salt; the other pair, similarly fed, none. In the course of a week it was easily seen that the salted pair had a much stronger appetite than the others, and after a fortnight it was increased to two ounces apiece. After four months the weight of the salted hogs was 350 pounds each, while that of the unsalted, five weeks later, reached only 300 pounds. The experiment was repeated with almost precisely the same results. The author feeds young pigs, according to their age, a quarter of an ounce daily; breeding sows very little during pregnancy, and during the heat of summer withholds it in a great degree from all, as it induces thirst and liability to disease.

ADULTERATION OF MILK WITH BORAX.

Borax has latterly been employed in Europe for the adulteration of milk. It hinders souring and curdling, enables the adulterator to dissolve brains and other raw materials for the artificial milk manufacture in larger quantity, and thus employ more water without risk of suspicion than can be done with the aid of soda, while the taste is less affected than by the alkali. This adulteration is easily detected by the chemist, but it might be practiced a long time without recognition by the uninstructed.

SUBSTITUTE FOR GUTTA-PERCHA.

At a late meeting of the French Academy of Sciences, M. Serres gave an account of the *balata*, a shrub which abounds in Guiana, and affords a juice which, he asserted, was superior for many purposes to gutta-percha, but especially as an insulating material for enveloping telegraphic wires. The milk or juice is drinkable, and used by the natives with coffee; it coagulates quickly when exposed to the air, and almost instantaneously when precipitated by alcohol, which also dissolves the resin of the *balata* juice. All the articles made with gutta-percha can be made with the sap of the *balata*, and it has no disagreeable smell. When worked up it becomes as supple as cloth, and more flexible than gutta-percha. M. Serres exhibited a number of articles manufactured of *balata* milk. Up to the present time it seems, from M. Serres's account, not to have become an article of commercial export.

SAWDUST AS A BEDDING AND AS MANURE.

"Dry sawdust," says a correspondent of the *New England Farmer*, "is one of the best articles for bedding horses and cattle, to take up the urine and keep the cattle clean. But hard wood sawdust is the best, and should be used freely for bedding, even if you have to go miles for it; it will answer every purpose of going to Peru after guano." Such sawdust put on land right from the saw, especially on a thin, dry soil, is of considerable value, as an experiment mentioned by the writer above quoted proves.

TREATMENT OF PEACH TREES.

R. Seamans, of Cecilton, Maryland, gives his plan of treatment of peach trees, which he cultivates on a large scale, as follows:

The tree should be wormed every year, and the second year the dirt should be taken away from the trees, and a shovel full of wood ashes thrown around each tree; when the trees are six years old, take the earth from the trees and off the roots for two feet out, worm well, and scrape the bodies from the roots to a foot above the ground; take a scraper like a vessel-mast scraper, and scrape all the rough bark off the tree; then make a solution of strong pickle and quicklime, have it of the consistency of thick whitewash, and make a mop of sheepskin, and mop the trees well, from the roots up a foot above the ground; do this in the month of May; let them remain so a week, then throw back the earth with a plough.

Trees will not require anything more done to them, but good cultivation and liberal manuring. Everything likes rich earth.

CHARCOAL AS A REMEDY FOR DISEASED PEACH TREES.

The editor of the *New England Farmer* says that a gentleman residing in Cambridge informs him that charcoal placed around the roots of the diseased peach stock was serviceable. He immediately removed the soil from around

the trunk of the sickly tree in his garden, supplied its place with charcoal, and was surprised at its sudden renovation and subsequent rapidity of growth, and the tenacity with which the fruit held on the branches, and the unusual richness of its flavor when matured.

NEW CANADIAN DYE.

Professor Lawson exhibited before the Botanical Society of Canada some specimens of a new dye of great richness, prepared in the laboratory of Queen's College, Kingston, Canada West, from an insect, a species of coccas, found for the first time last summer on a tree of common black spruce, in the neighborhood of Kingston. His dye closely resembles the expensive cochineal, (produced in warm countries only,) which is used for dyeing wool and silk a permanent red, crimson, or scarlet. Having been but recently discovered, a sufficient quantity has not been obtained for a complete series of experiments as to its nature and uses; but the habits of the insect, as well as the properties of the dye, seem to indicate that it may become of practical importance. In color, it closely resembles ordinary cochineal, having rather more of the scarlet hue of the flowers of Adonis autumnalis, and no doubt other shades will be obtained. The true Mexican cochineal is now being cultivated in Teneriffe, and other vine-growing countries of Europe and Africa, with such success as to displace the culture of the grape-vine; yet the directors of the East India Company offered in vain the sum of £2,000 for its introduction into India.

HOW THE CHINESE MAKE DWARF TREES.

We have all known from childhood how the Chinese cramp their women's feet, and so manage to make them "keepers at home;" but how they contrive to grow miniature pines and oaks in flower pots for a half century has always been much of a secret. It is the product chiefly of skilful, long-continued root pruning. They aim, first and last, at the seat of vigorous growth, endeavoring to weaken it as far as may consist with the preservation of life. They begin at the beginning. Taking a young plant (say a seedling or cutting of a cedar) when only two or three inches high, they cut off its tap root as soon as it has other rootlets enough to live upon, and replant it in a shallow earthen pot or pan. The end of the tap root is generally made to rest on the bottom of the pan or on a flat stone within it. Alluvial clay is then put into the pot, much of it in bits the size of beans, and just enough in kind and quantity to furnish a scanty nourishment to the plant. Water enough is given to keep it in growth, but not enough to excite a vigorous habit. So, likewise, in the application of light and heat. As the Chinese pride themselves also on the shape of their miniature trees, they use strings, wires, and pegs, and various other mechanical contrivances to promote symmetry of habit, or to fashion their pets into odd fancy figures. Thus they use very shallow pots, and the growth of the tap roots is out of the question; by the use of poor soil and little of it and little water strong growth is prevented. Then, too, the top and side-roots being within easy reach of the gardener are shortened by his pruning knife, or seared with his hot iron. So the little tree, finding itself headed on every side, gives up the idea of strong growth, asking only for life and just growth enough to live and look well. Accordingly, each new set of leaves becomes more and more stinted, the buds and rootlets are diminished in proportion, and at length a balance is established between every part of the tree making it a dwarf in all respects. In some kind of trees this end may be reached in three or four years; in others, ten or fifteen years are necessary. Such is fancy horticulture amongst the Celestials.

SORGHUM RED.

The sorghum has long been employed in China as the source of a red pigment or dye, and latterly the following process has been patented in Germany for the preparation of the coloring principle of this plant, which is largely in use in some parts of Europe as a fodder and as a source of alcohol. The bagasse (crushed stalks, from which the juice has been pressed out) is left to itself for some time until a species of fermentation has set in, in consequence of which the mass assumes a brown-red color. It is then dried and ground, and the powder is digested for twelve hours in cold river water. The water is then removed by pressure from the bagasse, and the latter is covered with a very dilute soda or potash lye which dissolves the coloring matter, and from this solution it may be separated by neutralization with a dilute acid. It is then washed with water and dried. This pigment is soluble in alkalies, acids, and alcohol. Salts of tin form the appropriate mordant for this color, which is durable.

IRON AS TONIC IN HORTICULTURE.

According to a Belgian horticultural paper, a Mr. Dubreiul, acting upon the experience that the leaves of a plant may be stimulated into a luxuriant growth by being moistened with a solution of copperas, applied a weak solution of this salt (half a drachm to a quart) to various kinds of fruit at a time of day when the same could not be reached by the rays of the sun, and at three different periods before their maturity. The first so treated are said to have grown to an extraordinary size.

AN INGENIOUS METHOD OF KILLING SLUGS.

An ingenious method of killing slugs and snails is published by M. Commandeur, of Paris.

Some time ago he accidentally left in his garden a pot in which he had been making experiments with starch and iodine, which pot, imperfectly covered with a bit of board, remained exposed to the heat and rain for three weeks, when, on looking one morning into it, he was surprised to find it tenanted by scores of snails and slugs that had congregated in it from every part of the garden. He repeated the experiment several times, and acquired the certainly that the emanation of iodine will attract these creatures from a considerable distance, when they may be killed by hundreds.

BENZINE FOR PLANTS.

The London Gardener's Chronicle gives the following advice respecting the destruction of insects on plants: "As our houses and gardens are always more or less infested with vermin, it is satisfactory to know that benzine, an article become sufficiently well known as a detergent, is no less efficacious as an agent in insecticide. One or two drops are sufficient to asphyxiate the most redoubtable insect pest, be it beetle, cockchafer, spider, slug, caterpillar, or other creeping thing. Even rats and mice will speedily decamp from any place sprinkled with a few drops of the potent benzine. A singular fact connected with this application of benzine is, that the bodies of insects killed by it become so rigid that their wings, legs, &c., will break rather than bend if touched. The next day, however, when the benzine has evaporated suppleness is restored."

TO TREAT POTATOES AND PREVENT ROT.

The Country Gentleman states that a foreign farmer came to the conclusion last year that the potatoe rot was caused by a minute fungus which commenced

on the leaf, propagated with great rapidity, and washed into the tubers by rains. He tried the following experiment to prevent its injurious effects, and was very successful. He planted potatoes in double rows instead of single, the two rows occupying about a foot in width, a foot of vacant space remaining on the outside of each row. They were planted upon the level ground and hoed up at the usual time. When the tops had attained their full growth, about the first of July, he turned them over right and left toward the vacant spaces by adding earth between the rows and pressing down the haulms, so as to prevent their retaining an erect position, and to allow the rain, instead of descending to the roots, to run off upon the vacant space. The result was, a most excellent crop, while other potatoes of the same species, planted in the same field in the common way, turned out a complete failure. This system can be easily tried without involving much extra labor or expense.

STORING POTATOES.

The following are a few very useful and timely hints on this subject, from the *Scottish Farmer:* Before the appearance of the disease, in 1845, it was quite common to store potatoes in large masses in houses. The roots would often keep sound in this state through the greater part of the winter. No fermentation was induced, and any little heat generated had the effect of causing the roots to sprout. Since that time, however, things have been entirely changed. In 1845 the larger portion of the crop was taken up to all appearance quite sound; but whenever it was stored in large pits, or in houses, a destructive fermentation was induced which speedily reduced the roots to a rotten mass. It has been observed that thunder-storms seem to stimulate the latent seeds of the disease, and promote first the destruction of the haulm and then that of the tubers.

It has been found that putting potatoes together in large quantities has often had the effect of spreading the taint through the whole. For this reason it is seldom that they are now stored in houses. The smaller the quantities that can be put together the better, as it will diminish the risk of their spoiling. The narrower, therefore, the pits are made, so much the more chance is there of the roots keeping through the winter, and not sprouting prematurely in the spring.

It is far from advisable to begin to store before the weather becomes cool, as heat is very apt to spread the destructive taint.

PRESERVATION OF POTATOES.

In the *Moniteur Scientifique* are given two modes of preserving potatoes so as to prevent their germination, which were introduced by the German chemist, Runge. The one consists in placing them for ten or fifteen minutes in salt brine, containing ten per cent. of salt; then, after removing them from the liquor, allowing them to dry on the ground, when they will be left covered with a thin coat of salt. The other mode is to soak them for five days in ammoniacal water, showing about one degree Beaumé.

KEEP HOUSE PLANTS CLEAN.

The London *Cottage Gardener* relates an experiment showing the advantage of keeping the leaves of plants free from dust. Two orange trees, weighing respectively eighteen and twenty ounces, were allowed to vegetate without their leaves being cleaned for a year; and two others, weighing respectively nineteen and twenty and one-half ounces had their leaves sponged with tepid water once a week; the first two increased in weight less than half an ounce each, while of the two latter, one had increased two and the other nearly three ounces. Except the cleaning, the plants were similarly treated.

PRESERVATION OF GRAPES AND OTHER FRUIT.

In southern Russia grapes are kept for sending to St. Petersburgh by gathering before they are fully ripe, and putting them down in alternate layers with well-dried millet grains in earthen pots. The grapes must not touch each other, and the pots are tightly sealed. They are said, in this manner, to keep an entire year, and to become very sweet.

In this country, packing in cotton is often resorted to. The grapes are left as long as possible on the vines—at any rate, until there have been some light frosts. They are then cut with a sharp knife, all imperfect berries are removed, and allowed to lie some days in a cool place. They are then packed in cotton, so that but few layers are formed, and stored in a place as cool as possible, but where they will not freeze. Kept in this way they are good until April.

It is said that cotton prevents or retards the ripening of winter apples and pears, while wool hastens this operation, and at the same time gives green fruit a handsome yellow color.

A Frenchman, M. Charmeux, who has lately excited great astonishment by the exhibition of fresh grapes in spring and early summer, employs the following methods:

The grapes are allowed to remain on the vines as long as the weather permits. They are then cut in such a manner that a piece of the vine remains on both sides of the stem of each bunch. It is best to leave two buds or nodes above, and three or four below. The upper end is carefully sealed with wax, the lower is inserted in a suitably sized vial filled with water, to which, in order to prevent decay, a quantity of charcoal powder is added. The neck of the vial is then closed around the bit of vine by means of wax. The grapes thus prepared are either hung up, or laid on straw or cotton, in a cool, not freezing room, where they keep with no other care than removing such berries as will from time to time occasionally decay.

SANDOMIR WHEAT.

BY CICHOCKI.

SANDOMIR WHEAT, well known under this denomination not only in our own country, but through the whole of western Europe, and especially in the harbors of the Baltic and German seas, is one of the sorts included under the general name of *Triticum sativum*, and consequently possesses common characteristics with the others. The cultivation of this sort of wheat, which has extended for a long time through the southern districts of Poland and the adjacent portions of Gallicia, has attracted and still attracts the careful observation of the agriculturists of Germany, France, and England, whose endeavor it is, by careful preparation of the soil and vigilant attention to the sowing season, to acclimatize this noble variety, the excellence of which overpasses that of any other sort or variety. But as far as my information goes, these endeavors have not been entirely successful; and in proof of this we may mention the fact that great quantities of seed of this particular sort are brought yearly for exportation to different parts of western Europe, where, after a few years' cultivation, it degenerates so far that it loses those noble qualities which give it precedence over all other sorts of wheat. Sandomir wheat obtained in this manner differs greatly as to its component parts from the original Sandomir wheat grown in Poland.

The best proof of the statement just made is the analysis of Sandomir wheat grown at Hohenheim, near Stuttgardt, near by Krocker and Horsdorf, and that made by Peligot of original Sandomir wheat. My own observations (made during my journey for agricultural purposes) with regard to the cultivation of corn are to the same effect as those of the agriculturists of the places visited, who, after many years of research, have come to the conclusion that Sandomir wheat may be profitably cultivated in their respective countries where the soil is clayey or *black loam*, (Redzina,) abundantly supplied with phosphates and ammoniates, or on soil which is not exhausted by esculent vegetables, and produces other sorts of wheat with moderate manuring, say four hundred hundred-weight of stable dung to a Polish acre, (one and a third English acre.) It was also observed that where the soil is rich it is very useful, after manuring, before sowing the wheat to sow early oats, or four-rowed barley, or winter barley. These two last are considered the best to sow before the wheat. Sown in this succession, it yields very beautiful grain on the banks of the Elbe, the Oder, the Vistula, and around the town of Maestricht, in Holland. It does not grow to straw, nor is it so easily laid, which very often happens on freshly-manured ground, and on that enriched by folding sheep upon it. The second place in point of suitableness for Sandomir wheat is occupied by green fallow land which has been sown with vetches or laves, (*vicia sativa*,) with buckwheat, (*fagopyrum*,) with succulent plants, with Indian corn, with trefoil, or with common clover. Pasture land which has been supplied with dung from year to year, or irrigated with dung water, yields very beautiful Sandomir wheat. Ground that has borne a crop of rape is considered as good as that which has borne winter barley, or beans in drills. In general, wheat grows best, and this fact holds good of Sandomir wheat in particular, on ground where forests have been recently grubbed up, or on ground which has been long used as pasture land, but on which a crop of lucerne has been first sown. On such soils the grain of Sandomir wheat is quite equal in regard to its component parts to the original Sandomir wheat grown in Poland after succulent plants, such as sugar beet root, or beet root for cattle, it is cultivated profitably, but under these circumstances it also degenerates. These observations evidently prove that for Sandomir wheat light soils (good sandy loams) are the best, which, in addition to proper quantity of mineral matters, contain a certain store of manure deposited at some considerable antecedent period in the earth, whilst soils recently manured, that have been cropped with exhausting plants, have a bad influence on this particular sort of wheat. It then runs too much to straw, and the grain is covered with a thick skin. We may remark the same effect in our own country, inasmuch as Sandomir wheat, transported to the northern districts of the country, after a few years of cultivation loses entirely its peculiar internal characteristics, and even changes its exterior appearance, whilst in those places where it is cultivated on soil rich by nature, and not stimulated by strong manure, but such as is thoroughly rotten, or has been mixed with earth, it yields good crops, and can be naturalized. It is true that it changes its exterior appearance, in particular with respect to the ear and its color, but the internal component parts of the grain and its size remain the same. It has proved in Saxony, and particularly in those places where guano is generally used in cultivation, that *guano* by itself, and *phosphate of lime* applied separately, produce a worse effect on wheat than a mixture of these two manures, but that the addition of a small quantity of *potash* to these two manures gives the highest results in the production of wheat. The country where Sandomir wheat is most cultivated commences at the southern declivity of the mountain of St. Cross, and extends over the Vistula into Gallicia, running in a direction from west to east from the neighborhood of Olkusz to the district of Lublin and Zamosz. The whole of this district possesses alluvial soil, being hilly in some places, and contains *gypsum*, sandstone, potters' clays, lime, chalk, and iron. The surface of the ground is not even;

on the west are mounds composed of magnesia, carbonate of lime, (dolomite;) on the north the mountains of St. Cross, (quartz, flint;) on the south some small hills known by the name of the Passer mountains. The substratum is generally such as is easily permeable by water, and where water cannot percolate the hilly nature of the ground enables it to drain off easily. The nature of the soil is such that it can only be regarded as difficult of cultivation under certain circumstances; for the most part it consists of a sandy clay, (20–50 p. ct. of sand,) which is easily carried by streams of water from higher to lower positions. We may observe that the roads after every shower, and particularly after heavy rain, are entirely covered with soil from the fields; and this is the best proof that the soil, in addition to the clay, contains a considerable percentage of coarse sand, which renders it soft, and facilitates the process of moistening.

The mechanical analysis of two sorts of soil from the district of Sandomir which we append below gives a better idea of the nature of this soil. One is taken from the village of Szwagrow, the other from Vursko, where Sandomir wheat of a superior quality is cultivated. The earth from Szwagrow contains:

	Earth from Szwagrow.	From Vursko.
Parts soluble in water	55.800	43.500
Parts not soluble in water	44.000	56.500
	100.000	100.000
Hygroscopic water	3.52 p. ct.	2.38 p. ct.

An analysis of these two soils made in the laboratory at Mariemont by Mr. Dudrewicz, professor of chemistry in that institution, gives the following results:

	From Szwagrow.	From Vursko.
Loss of weight by burning	4.37	4.22
1½ oxyd of iron	3.23	2.67
Clay	2.84	1.51
Lime	4.57	4.22
Magnesia	traces.	traces.
Potash and soda	0.32	0.17
Carbonic acid	1.43	1.73
Silicious acid	0.15	0.12
Nitric acid	0.57	0.25
Phosphoric acid	0.20	0.16
Sulphuric acid	0.37	0.25
Chlorate	0.06	0.04
Parts not soluble in diluted acids and alkalies	82.46	84.71
	100.000	100.000
Azote in 100 part of dried earth at + 100°	0.17 p. ct.	0.13 p. ct.

Two sorts of Sandomir wheat are cultivated in the district of Sandomir and in other parts of Poland, viz: with a beard or spines, and without them, both varieties being winter and spring wheats. The variety without spines is the

particular Sandomir wheat which is so highly prized; its ear is small, quite regular, of a red color, the chaff having no beard. The variety with spines is known under the name of Szkalmirka; its chaff is bearded; its color pale reddish; its surface even. The grain of both varieties is small, shiny, of a golden-yellow color, somewhat inclined to red. The true Sandomir wheat resembles in structure of the ear and in color the *Prolific Spalding's* variety, the difference being that the ear of the latter is twice as long and twice as thick, and its straw longer and harder. The Szkalmircz variety approaches very nearly to the wheat of the Banat of Hungary. Its grain is firmly fixed in the ear, and therefore not so easily wasted as the latter. Sandomir wheat is more capricious as regards its cultivation, requiring a more clayey and better-prepared soil, whereas Szkalmircz wheat is contented with inferior soil, and may even be sown on Redzina (black loam) clay intermixed with poor marl. The straw of Sandomir wheat is more delicate than that of Szkalmircz wheat, and consequently is more easily laid on the field than the latter—a thing which rarely happens when it is sown in drills. After having cultivated this variety in drills for some years past, I never had the misfortune to have had this sort of wheat laid in the field; and moreover I have obtained such satisfactory results, that sowing two bushels to the morg., (1¼ acre, 12 gavacy to 1 morg., new Polish measure,) from one gallon of seed sown in drills nine inches apart I obtained from one-twelfth of a morg. a return of thirty-seven gallons. Such a return is not to be despised. Both varieties of Sandomir wheat are able to bear the cold, and are not injured by the severest frost of our climate; but Szkalmircz wheat stands sharp winters without snow better than Sandomir wheat. The weight of Sandomir grain is very variable, according to the manner of cultivation and the kind of crop harvested the previous year on the same ground. On compact clayey soil, and on fallow ground, where rape-seed has been previously sown, and particularly after a crop of beans, a Korzec, (Polish measure,) nearly three-eighths of an imperial quarter of well-cleaned grain, weighs 261 Polish pounds; whilst, on the other hand, when cultivated after mixed succulent plants with fresh manure, after clover and drilled roots, the weight of one Korzec does not exceed from 220 to 240 Polish pounds. In bad years it does not weigh occasionally more than 200 pounds, or a little over. Whilst mentioning the weight of Sandomir wheat, I am obliged to acknowledge that wherever I found this sort cultivated abroad I did not meet with such a weight as that obtained in our own country; and this very circumstance is the reason why good, original Sandomir wheat fetches a better price in the harbors of the Baltic and of England than any other variety. I am of opinion that the virgin soil of North America, which has only recently been put into cultivation, would answer very well for this sort of wheat, as the primitive manure has not there been exhausted to so great an extent as in the countries of Western Europe where agriculture was sooner developed. As regards nutricious elements, the chemical composition of our Sandomir wheat places it in a much higher rank than any other sort cultivated abroad. Sandomir wheat cultivated for a few years at Hohenheim is much inferior, according to the analysis of Krocker and Horsdorf, to that which comes direct from the kingdom of Poland as analyzed by Peligot.

The former, when dried at 100 degrees, contained in 100 parts—

Gluten and albumen	17.15
Starch	53.37
Vegetable fibre, gum, sugar, &c.	25.52
Ashes	2.40
	98.44
Moisture in a fresh grain	15.48 p. ct.

The latter (Sandomir wheat from the kingdom of Poland) contained—

Water	13.2
Greasy matter	1.5
Azotic matter not soluble in water, (gluten)	19.8
Azotic matter soluble in water, (albumen)	1.7
Matters without azote, soluble in water, (dextrine)	6.8
Starch	55.1
Salt	1.9
	100.0

The superiority of the Sandomir wheat compared with other varieties seems to consist chiefly in *the thickness of the skin that covers the grain*, as well as in the greater quantity of azotic matter which the genuine Sandomir wheat contains. We have not, however, a sufficient number of comparative chemical analyses to enable us to give a positive opinion on this subject. Two experiments, one made on a Sandomir wheat probably degenerated, the other on a Polish wheat of the year 1844, (but whether a Sandomir wheat or some other sort is not known,) do not solve this question with certainty, as the experiments were made by different chemists and consequently by different methods, thereby giving different results. Krocker and Horsdorf designated azote by one symbol which includes many component parts, as their purpose was only to make a comparison of the quantity of nutritive matter in several sorts of wheat and flour; the azotic matter is therefore alone stated (leaving the gluten to be determined) as one item in the account. Their results are as follows: In 100 parts of dried grain—

	Talavera wheat.	Whitten glou wheat.	Sandomir wheat.	Single-grained wheat, (*Triticum monococum.*)
Gluten and albumen	16.52	17.09	17.15	13.20
Starch	55.25	52.45	53.37	54.63
Vegetable matter, gum, sugar, &c.	24.53	26.53	25.52	29.89
Ashes	2.80	3.13	2.40	2.10
	100.10	99.20	98.44	99.82
Quantity of water in grain dried in the open air	15.43	13.93	15.48	14.40

According to this analysis the Sandomir wheat scarcely differs from other sorts. Peligot made his researches with fourteen different sorts of wheat, and indicated many other component parts; but his results are imperfect from the want of any mention of vegetable matter and ashes, though it is well known that these are component parts of every sort of grain. As, however, the sum of the component parts in every analysis amounts to a hundred, it is difficult to guess whence arises this want of accuracy. The results obtained by Peligot are as follows:

Grain dried in the open air contains, as to its weight in 100 parts—

	Netherland white wheat, 1841.	Hard, from the car, 1843.	White Vousella, from Provence, 1842.	Polish, from Odessa.	Blé hérisson, 1842.	Poulard roux, 1840.	Poulard bleu commun, 1844.	Poulard bleu, in very dry year, 1846.	Mitadin du midi.	Polish, 1844.	Hungarian, 1845.	Egyptian.	Spanish.	Taganrog wheat.
Water	14.6	13.6	14.6	15.2	13.2	13.9	14.4	13.2	13.6	13.2	14.5	13.5	15.2	14.8
Greasy matter	1.0	1.1	1.3	1.5	1.2	1.0	1.0	1.2	1.1	1.5	1.1	1.1	1.8	1.9
Azotic matter soluble in water, (albumen)	2.4	2.0	1.8	1.6	1.7	1.9	1.8	1.4	1.6	1.7	1.6	1.5	1.8	1.4
Azotic matter not soluble in water	8.3	10.5	8.1	12.7	10.0	8.7	13.8	16.7	14.4	19.8	11.8	19.1	8.9	12.2
Starch	62.7	60.8	66.1	61.3	67.1	66.7	59.9	59.7	59.8	55.1	65.6	58.8	63.6	57.9
Dextrine, &c	9.2	10.5	8.1	6.3	6.8	7.8	7.2	5.9	6.4	6.8	5.4	6.0	7.3	7.9
(Cellulose,) vegetable matter, (fibre)	1.8	1.5	...	....	....	....	1.5	...	1.4	....	...	....	....	2.3
(Salt,) mineral matter	....	....	....	1.4	....	....	1.9	1.9	1.7	1.9	....	....	1.4	1.6

It is stated in one of the analyses that it was made with wheat from Odessa. There can be no doubt, therefore, that it was a wheat from the Ukraine; in the analysis it is only said that it was made with Polish wheat. We do not know whether this denomination is intended to designate Sandomir wheat, or some other variety from Dantzig, or some other sort, not a variety, called by Linnæus *Triticum polónicum*. Judging, however, from analysis and denomination, we may fairly infer that it was the wheat generally cultivated in Poland, and perhaps therefore Sandomir wheat.

This sort of wheat, according to Peligot, in regard to the quantity of azotic matter not soluble in water, (gluten,) is superior even to that of Egypt, which possesses more starch, whilst it is still further superior to other sorts. This analysis, however, cannot be strictly compared with that of Krocker and Horsdorf; it is imperfect from want of any mention, as stated above, of the quantity of vegetable matter, and the results were obtained by an entirely different sort of manipulation. The old method of analyzing grain, especially the manner of determining the quantity of starch and gluten, was not exact, as it consisted entirely in the mechanical separation of these matters from one another by a mode of washing them in water. Should we desire to compare with accuracy these two analyses, we should be obliged to do so after collecting all the detailed results of Peligot in one general cipher, and then considering his analysis as made on grain without water, or taking the analysis made by Krocker, by regarding it as made on a grain containing such a quantity of water as is stated by him. Calculating, in such a manner, the results of Krocker, we shall find that the quantity of azotic matter stated by Peligot to be 21.5, will be actually less than 17.15, it being really only 14.50. The difference would, therefore, be enormous. Should we desire to investigate still more closely the question of the value of Sandomir wheat, we should want an entirely new comparative analysis made by one and the same method, and with this object I intend to make an analysis of the following sorts of wheat exposed at the agricultural exhibition of Lowicz in 1858:

1. Sandomir wheat, from Utânowice, district of Sandomir.
2. Sandomir wheat, from Zagórzyce, district of Sandomir.
3. Sandomir wheat, from Strug, (prized,) district of Lowicz.
4. Talavera wheat, from Nasielsk, district of Pultusk.
5. Egyptian wheat, from Nasielsk, district of Pultusk.
6. Francony wheat, from Nasielsk, district of Pultusk.
7. White wheat, from Waliszewo, district of Lowicz.

Exposed at the agricultural exhibition of Lowicz in 1859:

8. Sandomir wheat, from Leszno, district of Warsaw.
9. Sandomir wheat, from Rodzuzhowo, district of Opoczno.
10. Bearded (with spines) white chaff, from Rodzuzhowo, district of Opoczno.
11. Talavera, (with spines,) from Willanowo, district of Warsaw.
12. Common wheat, from Ilgowo, district of Maryampol.
13. Common wheat, from Otgonowo, district of Wtoctanek.
14. Common Polish wheat, from Willanowo, district of Warsaw.
15. Common Polish wheat, from Nasielsk, district of Pultusk.

It is greatly to be desired that several sorts of wheat of the present year should be investigated, and the different soils carefully analyzed, and particularly those on which the Sandomir does not degenerate. From the results obtained from this analysis we should be enabled to draw more certain conclusions about the superiority of the Sandomir wheat over other sorts. We should arrive at a certain conviction that this sort is the most abundant in gluten and other azotic matters, has a comparatively greater quantity of starch, and differs from other sorts in the fineness of its skin, all of which we may infer from the analysis we already possess, and from the superficial appearance of the grain.

Of all the varieties of wheat with which I am acquainted the grain of that of Sandomir is the roundest, and, relatively to its thickness, shorter than the grain of any other variety. The grain cut across shows the least amount of incavation and the smallest vacuum; in short its grain approaches the nearest to the spherical form, or to that of an ellipsoid of small eccentricity; whereas the grains of other varieties are, relatively to their length, narrower and more flattened, and, by reason of their incavation, deviate from a regular outline. It is well known that the more regular the outline a body possesses, the greater are its contents in proportion to its volume, and consequently the smaller the amount of space wasted. The regularity of the outline of the grain of Sandomir wheat enables us to explain its greater weight, as well as the greater amount of flour it yields, inasmuch as there will enter into any given measure more grains of a regular outline, whilst each grain, having, in proportion to its volume, a greater weight and possessing a finer skin, will yield a less amount of bran, and therefore more flour. The fineness of the skin and small amount of waste in the grain influence this result. The greater weight of the Sandomir wheat may also be caused by the compactness of the contents of the grain. This is very difficult to determine, but by examining a grain cut in different directions with a magnifying glass, we obtain some remarkable indications with respect to this fact.

In what manner does Sandomir wheat degenerate? Whether this takes place in consequence of a change in the component parts, by which the grain becomes poorer in azotic matters, or in consequence of the loss of its primitive regular outline and the thickening of its skin, I do not know. The first supposition appears to be justified by the analysis quoted above, but as regards positive proof we should only obtain this from a comparison of the analysis of Sandomir wheat, degenerated and undegenerated, if we could have such grain from the same ground and cultivated in the same manner. This limitation is necessary, as great difference may arise from differences in the soil and in the manner of cultivation. As regards other reasons for the degeneration of Sandomir wheat, I presume satisfactory explanations can be given by agriculturists who cultivate this sort of wheat and make flour from it. Perhaps the millers would be able to furnish more accurate information upon the question. It is not even determined whether the degeneration of Sandomir wheat depends on climate, or the nature of the soil, or the manner of its cultivation, or, lastly, on the kind of manure employed.

The chemical analysis of two different soils on which Sandomir wheat suc-

ceeds pretty well, do not, in my opinion, coincide with the principles of science known and acknowledged as immutable. The reported want of magnesia in these soils is to me very striking and almost incredible, as it has been proved by many experiments that magnesia is absolutely necessary to the development of grain and cannot be replaced by lime. There are many facts to prove that the mere want of magnesia has caused failures in the cultivation of the choicest varieties of wheat, whilst in the ashes of grain magnesia may be found in great abundance.

If we may draw any conclusions from the mechanical separation of the component parts of the soils of Szwagrow and Vursko, where Sandomir wheat succeeds well, we must admit these soils to be clayey and among the heavier sorts. In the first, the soluble parts, or clay, are 55.8; in the second, 43.5. The soils with such a proportion of parts soluble in water belong to the heavier sorts; on the other hand, the soil of Sandomir, known generally, from its goodness and fertility, under the name *popielatka*, differs entirely in quality, (sandy loam.) Though Sandomir wheat succeeds well at Szwagrow and Vursko, it may, perhaps, degenerate there and require fresh original seed. Whether this supposition be true or not, there will be no difficulty in ascertaining. Among the many analyses of the soils of the kingdom of Poland that have been made to elucidate this question, that of *popielatka* (sandy loam) has particularly attracted my attention. Two analyses of this sort of soil were made in the chemical laboratory of the late agricultural society, the one of earth taken from Bidzin, in the district of Sandomir, the other of earth from Wiszniowo, in the district of Tomaszów. These analyses, as well as the information we have received from our correspondent in the district of Tomaszów, show that the *popielatka* is a somewhat light soil, easy of cultivation in consequence of its moderate compactness, and one that readily absorbs superfluous moisture; one, moreover, easily warmed; in short, it is a soil warm and fruitful by nature. The analyses referred to above, evidently demonstrate that this soil contains a great quantity of organic matter, with a sufficient quantity of lime and magnesia. These analyses include many component parts under general ciphers, as they were only made for the purpose of classification; the soils, however, though taken from places very distant from each other, bear a strong resemblance to one another; indeed, they are almost identical, hardly differing at all at first sight.

The mechanical analysis, made by washing in water, gives, in 100 parts of *popielatka:*

	From Bidzin.	*From Wiszniowo.*
Coarse-grained sand	14	2
Thin-grained sand	64	76
Washable parts, or clay	22	22
	100	100

The chemical analysis shows still further the identity of these sorts. Its results are as follows:

	Bidzin.	*Wiszniowo.*
Hygroscopic moisture	1.550	1.753
Organic matters, (burnt)	4.070	4.170
Oxyde of iron, clay, and phosphoric acid	3.553	3.180
Lime, (Ca. *O.*)	0.806	0.442
Magnesia, (Mg. *o.*)	0.259	0.211
Parts not soluble in acids	88.963	89.756
Alkaline salts, carbonic acid, sulphuric acid, silica, and other matter not examined, as well as the loss	0.799	0.488
	100.000	100.000

Supposing that the *popielatka* is most suitable for the cultivation of Sandomir wheat, we should be obliged to admit that it requires a soil light, not clayey, not very compact, readily permeable by liquids, easily warmed, and containing large quantities of vegetable matters easily decomposed, which are particularly required for the nourishment of plants and the development of their organic substance.

This supply of organic matter in the soil itself by nature, which only in a very few cases can be augmented by culture, agriculturists call "the old power of manure," or "the old manure of the soil." It is not difficult to augment the quantity of organic matter in the soil by richly manuring it with turf, but the decomposed vegetable matter contained in this, is not of such a nature as to aid in the development of the life of plants, and has entirely different properties from the *humus* (*pruehnica*) found in dry soil. Indeed the latter may differ greatly from natural humus formed from different matters and under difficult circumstances. To supply the soil with this kind of humus is a work of considerable time, as vegetable matter introduced into the soil is exposed to continuous atmospheric action, and, turning into gasses, evaporates from the ground.

If we were convinced that only upon such soil as *popielatka* Sandomir wheat does not degenerate, we might infer from this fact that the degeneration in other localities is caused by an unsuitable soil, one, for example, too heavy or too clayey, such soils being usually the only ones indicated for the cultivation of wheat. To this cause we may add another, viz: the use of a strong, fresh manure. I am not acquainted with more minute particulars respecting the cultivation of this kind of wheat in those localities where it does not degenerate, but I know it to be a fact that the soil in the district of Sandomir is not richly manured and that wheat does not always have fresh manure. Consequently it is very probable that Sandomir wheat does not like fresh manure and heavy soil, and that it therefore easily degenerates when cultivated under such circumstances.

In an analysis of Sandomir wheat 100 parts were found to contain:

	Starch.	Azotic matter, as gluten, albumen, &c.	Matter without azote, as sugar, gum, and grease.	Vegetable fibre.	Mineral matters.	Water.
Sandomir wheat from the village of Utanowice, district of Sandomir, community of Witowice	60.52	15.65	7.37	3.17	1.68	11.71
Sandomir wheat from Zagoryce, district of Sandomir	61.86	13.55	7.64	3.58	1.96	11.41
Sandomir wheat from Strug, district of Lowicz	58.05	18.23	7.44	3.04	1.84	11.40
Talavera wheat from the estate of Nasielsk, district of Pultusk	62.23	14.35	7.11	2.58	2.05	11.68
Common wheat from the estate of Ilgowo, district of Maryampol	62.45	15.96	7.25	1.21	1.54	11.59

However the wheat of Sandomir at first sight distinguishes itself by the thickness of its skin, the analysis shows regularly a greater quantity of *vegetable fibre*, and therefore it requires the proof of a greater number of analyses of this kind of wheat, as well as of the other sorts.

SALT MARSHES.

THE MODE OF RECLAIMING THEM AND THEIR VALUE.

BY WM. CLIFT, STONINGTON, CONNECTICUT.

WHOEVER expects sudden riches by reclaiming these meadows may as well pass this article for a more congenial theme. It is only for the benefit of those who are willing to work and are content with a generous reward for their toil that I write. If such own salt marshes, or are so situated that they can conveniently work them, it will be a good investment to purchase and reclaim them if they can be bought at their present value to their owners. Purchased at a fair price and skilfully managed, they will produce more grass and better hay than any other class of lands in the country. They extend all along the Atlantic coast, and as far up the navigable rivers as the tide flows, and along the banks of shallow streams and creeks. Their fertility is inexhaustible, as they are either regularly or occasionally flowed by the tide which leaves a rich deposit upon them. They have been formed, doubtless, by the overflow of the rivers, by the tides, and by the decay of the vegetation that grows upon them. Some of them have been so much raised by these causes that they are only overflowed from the sea in extraordinary tides, and produce black marsh grass and blue top—the best kinds of grass that grow upon these meadows. Some of them have been made from fresh-water swamps by the breaking in of the sea. This is the case with the marsh upon my premises. The stumps of maples and other trees that grow in fresh water swamps are found about eighteen inches below the surface. Fresh-water mosses and the roots of ferns are also found at the same depth; showing that the tide did not flow there when they were living plants. All above that has been formed by the deposits of the tides and the decay of marine vegetation. The coast is continually undergoing changes from the action of the sea. In some places great banks of sand and gravel are formed that last for generations, and in others they are washed away. When the grass was left uncut and was not pastured, as was the case before the country was settled, the elevation of the soil must have been more rapid than at present.

When the country was first settled these marshes were depended upon a good deal for hay during the winter. Even fifty years ago they were prized much more highly than they now are. They were greatly desired by farmers living back five or six miles from the coast, and a common price was a hundred dollars an acre for land that would not cut two tons to the acre. The result of this former high estimate of these marshes is seen in the fact that they are now often owned in small parcels of from five to ten acres, having been inherited by farmers living far back in the country. They are still mowed by their present owners, or rented, but the price has greatly depreciated. They are chiefly valuable for yielding early pasturage, and the hay is better for bedding than for fodder. It is sometimes mixed with upland hay, both in the barn and in the stack. They are found to do much better with ditching, as the salt water, wherever it stands habitually after the tides, destroys the grass. Many of the marshes about the mouths of rivers and creeks are flooded every tide, and the grass has to be cut and carried to the adjoining upland for drying. This adds much to the expense of curing the hay.

Other marshes are flowed only by the highest tides, and by selecting the period of low tides in the month, the hay can be cured on the ground. It is usu-

ally stacked on stakes driven into the marsh and left about three feet above the surface. A platform is built upon these stakes, which keeps the hay out of the water. The estimated value of this hay differs much in different localities. The most intelligent farmers value it simply for bedding, and the price of straw regulates the price of marsh hay. In other places it is thought to be about half the value of good hay, and this is the more common estimate. But it may well be doubted if this hay ever pays for cutting where it is used for fodder. It has too much salt and too little nourishment. Away from the immediate neighborhood of cities and villages, these lands can be bought from five to twenty dollars an acre; and that is more than they are worth as they are now managed. These marshes embrace many millions of acres, and offer the best fields for agricultural improvement along the seaboard. Sometimes they lie in large tracks of several thousand acres, and again in small patches of ten acres or less. Many of them would require but a small capital, and could be easily managed by a single individual of moderate means, while others would require a large capital and an organized company. Some of them lie inside of railroad embankments, and the principal part of the expense of reclaiming them has already been laid out. With the exception of a few isolated cases, nothing has been done toward reclaiming them. If it has ever occurred to their owners that it is possible to grow the cultivated grasses upon them, they have no faith in its practicability. Some even quote Scripture against the endeavor to reclaim them, as if the doom of Sodom rested upon every "salt land," that it "should not be inhabited." There seems to be a much greater doubt about reclaiming salt marshes than about fresh-water swamps. These have so long been brought under cultivation, and there are so many cases of success in almost every town, that public opinion has been changed in regard to them. Salt marshes generally require more labor and capital to bring them into upland grasses, and they are very generally owned in company—a piece of a hundred acres not unfrequently having a dozen or more proprietors. If a part of the owners desire to do something, the others, quite likely, do not believe in improving the works of the Almighty, and argue that salt grass is better than clover and herds grass. They cannot, however, remain long in their present unproductive state. The economy of shutting off the sea-water from them has been settled beyond dispute, and they are located upon the seaboard where lands bear the higest prices, and all agricultural products are in greatest demand. Large tracts lie in the immediate vicinity of cities, where hay and milk have their best markets. They can be brought into grass without ploughing or stocking-down in the ordinary methods, and they are probably better adapted to grass than to any other product. It is for the purpose of furnishing useful hints to those who are about to undertake these improvements that this article is prepared.

THE EMBANKMENTS

are the first thing to be considered in reclaiming a marsh. These will have to be more or less strong and expensive, according to their location in reference to the sea, the extent of the land they guard, and the character of the creek or river for floods. If a railroad embankment runs in front, as sometimes happens, the most expensive part of the work is already done. The shore-line road from Boston to New York crosses a large number of these marshes in the State of Connecticut, and thousands of acres will need no other protection from the sea. This is the case, probably, with shore roads in other States. Where a marsh lies directly upon the sea it will be necessary to have a substantial sea-wall built, and the inside made tight by an embankment.

As the whole success of the experiment depends upon shutting out the sea, this work should be done in the most thorough manner. The wall should be put back from the water a little distance, so that the waves, in ordinary tides,

will not act upon the base and undermine it. It is advisable, in all cases, to have the bank broad enough to drive a loaded team upon it; and two or three feet higher than the extreme sides. The road-way will be a convenience in moving hay or manure, and the carting upon it will serve to make it more solid and durable. The inside of the wall may be filled with gravel, loam, or sods, and marsh mud taken from the ditch. It is always desirable to have a ditch within a few feet of the embankment, on the marsh side, to make the drainage perfect. If mud and sods are used for the main body of the bank, they should be covered with a layer of gravel a foot or more thick. By a little care in cutting the sods, and laying them upon a regular slope, a handsome terrace will be formed, which will not only yield grass, but will be much more durable in case the marsh is ever flooded by a rise of water in the creek or river.

If the marsh does not face the sea, and is not exposed to heavy tides or floods, a much less expensive embankment will answer. It may be made without stone, by having a section of clay or clay loam, about eighteen inches in thickness, running through the middle of the embankment, in the manner described in the improvement of Colonel Hanks upon a subsequent page. Both sides of the dyke may be neatly turfed, and will last for generations. This kind of embankment is well adapted to land upon small creeks and streams, where little violence is offered by the waves or by the pressure of high tides.

THE TIDE-GATE

is the next thing in order. The object of this is twofold—to pass off the drainage water and to prevent the influx of the tide. To accomplish this a culvert must be made somewhere in the embankment and the gate be fitted into it. Where a sea-wall is necessary, the culvert should be built of stone, laid in cement, in the most thorough manner. Very much of the success of the enterprise will depend upon the tightness of the culvert and gate. In other locations a stout plank culvert will answer well enough. Chestnut and white oak are durable woods in such positions, and should be selected where they are available. Descriptions of tide-gates will be found on subsequent pages, and quite likely there are other plans just as good or better than these. The essential things in the gate are, that it should move rapidly upon its hinges, opening with the current from the drainage-water as the tide falls, and shutting with the rising tide; that it should shut close, and that it should be made of durable material. It is also desirable that the gate should be lined with yellow metal, or with copper sheathing, to prevent the gnawing of muskrats, which are one of the greatest pests about these reclaimed marshes.

THE DRAINAGE

should receive attention immediately after the embankment and tide-gate. A first essential of success is a tide-ditch completely surrounding the marsh. This should be dug as deep as it is desirable to drain—from two to four feet, according to the fall. If the contents are desired for muck to put in yards or stables, as is generally the case, the ditches may be cut down to the hard pan, and be made six feet wide. They will then answer the purpose of a fence.

Where the embankment crosses a creek or small brook, as is often the case, this will serve for the main drain through the centre. For convenience in mowing and carting, it will pay to straighten the creek, and to make it wide and deep enough for the stream at all times. These cross ditches will be needed to run from the sides to the main. The frequency of these ditches cannot very well be determined beforehand. In localities where there is a difference of five or six feet between high and low water in ordinary tides, the drains can be cut deeper and further apart. If the difference is not more than two feet they must be closer together. The vegetation, after a year or two, will show whether

more drains are needed. If rushes and sour grasses make their appearance it is pretty good evidence that more drains are needed. It would undoubtedly be an advantage to have these cross drains made of two-inch tile, laid upon narrow strips of board, but this is much less necessary than upon ordinary swamp or clay land. The sod is very tough, and I find that cross ditches, cut eight inches wide and about two feet deep, five years ago, are nearly as perfect as they ever were. The meadow will be kept in grass, and there will be no danger of their filling up from the surface as if the land were to be cultivated. To facilitate carting and the use of a mowing machine, the ends of these cross ditches may be covered for twelve or fifteen feet, making a duct of two-inch tile. This arrangement has worked well on my marsh, and does not interfere much with carting.

As the only object of these cross ditches is to pass off the surface water, they may be made very narrow, say six or eight inches in width. With a spade made for the purpose, they may be cut to the depth of three feet very rapidly.

I think in ordinary cases, where there is a demand for muck upon the farmer to make manure of, the whole expense of cleaning old ditches and making new ones will be covered by the value of the muck. In my own case, as the muck is worth a dollar a cord upon the banks of the ditches, the ditching has been a source of revenue. The mud taken from the old ditches, and the turf and muck from the new ones, will form a very important item in the value of these marshes. This material has not been at all appreciated by our shore farmers; and in some places, owing to the want of skill in using it, there is a prejudice against it. Taken from the ditches and applied directly to the land, it contains so much salt and other injurious matters that it kills the seed and prevents a crop the first year. It should be allowed to lie six months or a year before use, or pass through the stable or yards on its way to the ploughed field. For the purpose of testing the value of this material, both before and after reclaiming, I had two samples sent to Professor Samuel W. Johnson, of Yale College. His analysis of the mud taken from the ditch where the tide flows gave the following results:

Organic matter soluble in water		5.40
Organic matter insoluble in water, but soluble in soda, (treated five times,)		16.72
Organic matter insoluble in water and carbonate of soda		7.25
Total		29.37
Inorganic matter soluble in water	7.40	
Inorganic matter insoluble in water, but soluble in carbonate of soda, (treated five times,)	6.40	
Inorganic matter insoluble in water and carbonate of soda	48.05	
		61.85
Water		8.78
		100.00

Nitrogen 1.32 = 1.59 ammonia.

He remarks that the portion soluble in water contains sulphuric acid, chlorine, iron, lime, potash, and soda in large quantities. After such treatment as is adapted to remove or decompose the soluble iron salts, (composting with lime, fish, or stable manure,) this mud must make an excellent fertilizer, as it contains much more saline matters than are met with in any muck or peat, and is by no means deficient in nitrogen. The quantities at the disposal of the farmers along Long Island Sound are immense. In another analysis, in which the ingredients are calculated in the dry state, he makes the potential ammonia of the organic matter in this sample 5.41, which is over two per cent. more ammonia than the average found in peats.

The other sample analyzed was taken from new ditches dug two years after

the tide-gate was put in. Its composition is more like that of fresh-water swamps. The color is a rich snuff brown. The analysis gives—

Organic matter soluble in water		3.33
Organic matter insoluble in water, but soluble in carbonate of soda		51.68
Organic matter insoluble in water and soda		9.80
Total		64.81
Inorganic matter soluble in water	2.82	
Inorganic matter insoluble in water, but soluble in carbonate of soda	0.70	
Inorganic matter insoluble in water and soda, (7.45,)	5.16	
		8.68
Water		26.51
		100.00

Nitrogen 0.95=1.16 ammonia.

He remarks that the presence of so much (8.4 per cent. of the dry muck) soluble matter is the reason why it must be weathered or composted, and those soluble bodies are chiefly common salt, sulphate of magnesia, and perhaps alkaline, crenates, and humates, which are partly washed out or destroyed by weathering.

It is probably these saline matters towards which the affinity of the roots of vegetables and garden plants is especially manifested. I have made a large use of this latter kind of muck, for the last five or six years, both for top dressing the reclaimed marsh and for hoed crops in the field and garden. It is excellent for all field and garden crops and for all kinds of fruit trees upon which I have yet used it. Grape-vines and strawberry plants show a strong affinity for the bits of salt marsh turf in the soil. The roots are so matted in with it that it is impossible to separate them. I have used less of the other, because it is more inaccessible and costs more for carting. I have no doubt of its superior value. I have found an unexpected advantage in the use of the sods taken from the surface where new ditches have been opened for bedding. These sods cut about a foot square become very dry and light in the course of a summer, and are then put under cover. When packed in a close bed under horses and cattle, they absorb water better than anything I have ever used. When saturated with urine, they are thrown into the barn cellar and another bedding of sods supplies their place. In this way manure is made very rapidly, and the hoofs of horses are kept in the best condition. I have no doubt that in all cases where the reclaimed marsh is within a mile of the barn or the fields where the manure is wanted, the ditching will be made a source of income instead of a bill of expense.

BREAKING UP.

I find the general impression is, that it will be necessary to plough before these lands can be stocked with grass. This is sometimes done, but I think few have found it the better course. The sod is so tough that the ploughing is very hard; and it takes a long time to rot the sod in the ordinary process of cultivation. The better way is to sow the surface with grass-seed within six months of the time when the tides are shut off.

THE SOWING OF GRASS-SEED

is always advisable, by way of experiment, if it does not cover the whole marsh. But without sowing, the grass will generally be doubled the first year, and the

quality be so much improved that cattle will thrive upon the fodder. In marshes situated like that of Mr. P[illegible], at the mouth of a fresh-water stream, subject to overflow, and so scatter[illegible] and grass-seed by the process, sowing may not be advisable. In all other cases I have no doubt it will pay abundantly. Sowing immediately after the tide is shut off would probably kill many of the seeds on account of the saltness of the surface. But after a few heavy rains there will be no danger from this source. The best season for sowing is either in the spring upon the late snows, or in the last of August or first of September. If sown late many of the roots will be thrown out and winter-killed.

The spring is much the best time for sowing clover-seed. If this is done in March, the alternate freezing and thawing will open little cracks in the soil and cover the seed. It must not be expected, however, that one sowing of seed will last forever; this is not the case upon the best upland meadows. Sow from year to year, as the barren places or the weeds indicate the necessity of grass. It will spring up and yield abundantly, some twenty, some sixty, and some an hundred fold.

MANAGEMENT.

It is quite evident from the improvements recorded in subsequent pages, that the dyking and draining of the marshes will pay abundantly, if nothing more be done with them. It may be safely calculated that the hay will be doubled in quantity, and that one ton of the sweet hay will be worth as much for fodder as three of the salt.

Whether it will be desirable to do anything more than this will depend somewhat upon the location of the marsh in reference to a market, and the amount of capital at the command of the owner. If the marsh is at a distance from the barn and from a good market, it may be the best thing to do nothing more than sow seed and use it for a pasture. It will be found to give a good bite of grass earlier in the spring than the upland, and to hold on later in the fall, But in case of marshes conveniently situated, I think it will be a good investment of capital, to make further improvements.

Not more than a ton and a half to the acre can be expected without top-dressing of some kind. With this they can be made to yield from three to four tons to the acre, besides a large crop of after feed. Almost any kind of gravel, loam, or sand from the adjacent uplands will be found to increase the yield, even if it is not spread more than half an inch in depth. A composit of loam or muck and manure will do still better. I have found that manure, spread as a top-dressing, pays quite as well as upon upland meadows. Oyster-shell lime is a valuable dressing, and where this article can be had cheap, as is generally the case in the vicinity of large cities, it will be one of the cheapest amendments; wood ashes are valuable, but generally too scarce and dear upon the seaboard to be available. Hard coal ashes will pay for carting a mile or two, where they can be had for the gathering in the cities. It should not be thought a hardship to do something for land that yields so abundantly. We are continually ploughing, manuring, and stocking our upland meadows to make them yield a ton and a half to the acre, and this is much beyond the average. The dyked marsh, with a much less outlay, will yield a far more remunerative crop.

To show what has been accomplished in this department of husbandry, I will give you somewhat in detail the results of several experiments, the most of which have come under my own observation.

A Massachusetts farmer gives the following account of his reclaimed marsh: "I have cultivated, or rather taken, a crop of two or more tons to the acre of best English hay from my marsh for years, and the pasture holds out late. I know not much of fresh-water swamps, but my experience on salt marsh is entirely satisfactory. It is sorrowfully true that very little is written on this subject, yet there are enough worthless salt marshes on our seaboard to feed

thousands of cattle, that may be reclaimed at very small expense. Even while the marsh remains salt, after the gate is put in, the double quantity of ameliorated hay will well repay the labor in many cases, and by degrees, and constant sowing, the best grasses will gradually root out the old covering. I had my marsh turfed the first year, one or two inches deep, by a knife made for the purpose. This was heaped up and dried, then burned. A small spot sown with clover, where the ashes were spread, produced a fabulous crop. The alkali corrected the sourness of the land, and as the clipping was all fibre, the ashes were abudant. This cost about twenty-five dollars per acre by the job. It may be too much expense, but it worked well. I now occasionally manure the land as I would other land, and consider it the cheapest meadow I have. I prefer stable manure, yet I have used guano with success."

In the summer of 1858 I met with a New Jersey farmer who has had a good deal of experience in reclaiming this kind of land. The Jersey marshes are famous for their extent, embracing a great many thousand acres between the shores of the Hudson and Passaic rivers, and various attempts have been made at improving them. They have resulted successfully wherever the work has been skilfully and thoroughly done. Very fine nursery grounds and vegetable gardens are to be seen on these marshes as you go by rail from New York to Newark.

The gentleman named owned five hundred acres of marsh. His first experiments were made with a horizontal tide-gate, which proved unsuccessful. The hinges were very likely to get foul with mud or grass, and a very small obstacle prevented the tide from closing the gate. The water would find its way in, in the high tides and rains, and flood the land. After putting in the perpendicular gate, which closes by its own weight when the tide begins to rise, he succeeded perfectly. He has fixed four or five acres in the most thorough manner, and has cut four tons to the acre. He ploughs once in six years, and lets the land lie fallow one year, that it may have the full advantage of the summer sun and the winter frost. He puts on a hundred bushels of lime to the acre, and uses poudrette and other manures. He mows two crops of grass in a season. He keeps the hay until winter, when he sends it to the New York market and sells it for twenty dollars a ton. He has known but one winter in twenty years when hay in the city would not bring this price. He estimates that his five hundred acres of reclaimed marsh will bring him in an income of thirty thousand dollars a year. This would be sixty dollars an acre. He allows one-quarter for the expense of cutting, marketing, and keeping up the land. This is quite respectable farming. It will be noticed that his method differs from the Massachusetts farmer in ploughing the land once in six years. This is probably owing to the fact that portions of these Jersey marshes have been a long time reclaimed, and the salt marsh sod has had time to disappear. The treatment is more like that which would be desirable for a fresh-water swamp. This marsh, too, situated near the mouth of a large river, and often overflowed by fresh water, probably never had so fresh a sod as grows upon marshes that are flowed only by the tides.

Mr. T. F. Lambson, of Salem, New Jersey, has devoted a good deal of time and expense to these lands. He recommends very thorough drainage, and says that no lot of marsh should contain more than ten acres. If any rain water should lay upon these lots, it will be necessary to cut small drains to let it pass off freely; these might be covered where the materials are at hand. The mud and earth which come out of the watercourses and ditches should be removed into the lowest part of the marsh. By a neglect of this the rain water will be confined too long upon the surface, and the most luxuriant growth of timothy or clover will in a short time be converted into a nursery of rushes. The best time to sow down to grass is when the tide is first shut off, and when the mud is soft. A growth of coarse grass will spring up sufficiently to protect the pure

grass in its tender state. This crop should be mown off, and not suffered to lodge upon the marsh. Timothy and herds grass require about one bushel to sow four acres. The former will flourish where the water can be kept two and a half or three feet from the surface; where it approaches nearer than this in the ditches the latter will succeed best. In order to avoid having it sown in rows, it should be sown a second time across the first sowing. It is not advisable to mow more than three years in succession; to mow and pasture alternately is the better plan. If the high marsh becomes bound and unproductive, ploughing will be necessary; and, after raising two or three crops of rye, Indian corn, or broom-corn, without the application of any manure, the soil will be quite renovated, and when sown down in grass will be much more productive. When the earthy deposit is several feet in depth it will not soon become exhausted. Where it is not desirable to plough, lime may be used with success. Low marsh or turf, or, as we term it here, "horse-dung" mud, should not be ploughed. When it becomes unproductive a covering of clay or loam to the depth of two or three inches will be found the cheapest application. By herds grass Mr. Lambson properly means red top. Timothy and herds grass are both applied to one plant *(Phleum pratense)* in New England.

Mr. Morgan's improvement.—The farm of this gentleman lies in Groton, Long Point, a few miles east of New London, Connecticut, and just south of the railroad. The marsh lies around a small lagoon, about equally distant from the east and the west shores of the Point. It consists of some twelve or fifteen acres. Originally there was an outlet to the waters of the lagoon on both shores; and at every high tide, at the full of the moon, the marsh was covered. A part of it was covered with flags, and the rest with black marsh and other salt grasses. Parts of it were so soft that a loaded cart could not be driven over it. Ten years ago an embankment was thrown across the west end and the outlet stopped. A straight ditch was then dug from the lagoon to the east shore, and near the breach a cheap flume and tide-gate were put in. There was but a single gate, and the tide was never so perfectly shut out that sea-water did not run into the ditch in considerable quantities. But, notwithstanding the imperfectness of the work, a great change was visible after a year or two. Marsh blue top, a grass that is generally found around the edges of marshes, had spread all over it, and occasionally upland weeds, the dock, dandelion, and four o'clock were seen. No grass-seed was sown except the sweepings of the barn-floor, so that the productiveness of the land has not been fully tested. About a ton of hay to the acre is cut every year. The testimony of the tenant of the farm, Mr. Clark, as to the value of the hay for fodder was, that it was nearly equal to English hay; that the cattle ate it well and kept in good condition upon it through the winter. It was the sweetest hay he cut upon the farm. We notice here, in passing, three important errors into which Mr. Morgan has fallen, which account for the small yield of hay. The flume and gate were imperfectly made. These ought always to be made of the best materials—sound oak or chestnut plank—and by a carpenter who can make a close-fitting joint. This is the foundation to the whole improvement, and no expense should be spared to make it in the most durable manner. A second error was the absence of side and cross ditches to carry off the rain water sooner. The amount of water which flows in upon a marsh situated like this, in a basin, is much greater than that which falls upon the surface, A ditch at the edge cuts off all the drainage water from the surrounding hills, and cross ditches at intervals of three or four rods carry off the rain water, Without this precaution the grass will not grow as well in summer, and will be liable to be winter-killed by the rain freezing as it falls. A third error was the neglect to sow grass-seed upon the sod. Many small patches were naked, and the grass quite too thin over the whole surface. It matters not how rich the ground may be, or how well prepared, unless the seed is put in there will

not be a remunerative harvest. Twenty dollars spent in hay seed on these acres would have paid a large interest.

Honorable James A. Bill's improvement.—This marsh differs from those already noticed, in the fact that it lies upon the banks of a fresh-water stream, and was accustomed to be flowed by brackish rather than salt water. Mr. Bill's farm lies near the banks of the Connecticut, some five or six miles from its mouth, and the marsh upon both sides of a small creek that flows into the river. Before the improvement the tide flowed twice a day into the creek, and at all high tides the meadow was flooded. Of course only the flags and the coarse grasses that love salt could flourish. The difficulty of cutting and carting the hay made it almost worthless to the owner, and he was glad to sell it at twenty dollars an acre. Indeed, so poor was the quality of the hay that it may be doubted if it ever paid for mowing. It was chiefly valuable for bedding, an article much more cheaply furnished from the straw of rye and oats. The embankment is made in the most thorough manner. It consists of double walls, some twelve feet apart, and filled in with earth; on the inside of the walls runs a double row of plank driven about five feet deep into the mud and battened with inch boards, so that no water can get in except at the culvert. As the embankment was but a few rods in length, it was not a very expensive job. The culvert is made of heavy plank running the whole width of the dam, and about six feet long. It is bedded in the mud and made perfectly tight at the sides, so that all the water is compelled to flow through it. At each end of the culvert is a strong bulkhead, and at the bottom a tide-gate the whole width of the flume. The gates are about two feet high and hung upon strong iron hinges. The current of the creek pushes them open and the current of the rising tide shuts them, so that no salt water can flow in, or, at least, not enough to do any damage. While the tide is up, of course there can be no flowing out of fresh water, and all that runs in the creek accumulates in the ditches. In case of heavy rains in the winter and spring, this sometimes leads to an overflow; but in summer when the grass is growing the ditches will hold all the back water; and even in case of an overflow, the fresh water lying upon the meadow an hour or two would not damage the grass. The creek was straightened in many places, and a four-foot ditch, about a mile in length, was dug around the edge of the marsh to cut off all water from the upland. Cross ditches about a spit wide were opened to take off the surface water. The whole surface has become so solid that a loaded team can be driven all over it.

Mr. Bill's original idea was to put the whole into cranberries, as the fruit grows naturally upon the upper part of the marsh; but his unexpected success in raising hay diverted him from this object. The hay is of good quality, and is eaten with as good a relish as upland hay. The flags and coarse grasses have disappeared and blue top and other grasses have come in, probably through the agency of the brook that empties into the creek at the upper end of the marsh, and in heavy rains and high tides floods it. Mr. Bill once tried the experiment of breaking up a piece of the turf and sowing with buckwheat, but it was a failure. The crop grew well, but was drowned out by an unexpected flood in the Connecticut. Grass is unquestionably the most profitable farm crop that can be grown upon it. The account with this marsh stands about as follows, according to Mr. Bill's reckoning:

Dr.

To thirty acres of land, at $20 per acre	$600 00
To expenses for dam, ditching, &c	900 00
	1,500 00

	Cr.
By average crop of hay, two tons to the acre, at $12 per ton.....	720 00
Deduct $3 per ton for harvesting	180 00
It leaves	540 00

as his annual interest upon a capital of fifteen hundred dollars. Judging from the crops of seven years since the tide-gate was put in, there is little doubt that this meadow will yield two tons to the acre without any other top-dressing than it receives from the floods in the creek. If it were to be sown with clover, herds grass, and red top, and to be top-dressed with compost or stable manure, it would yield three and a half or four tons to the acre. No land makes a better return for manure than these reclaimed marshes. Whether this would pay or not would depend somewhat upon the owners facility for making or purchasing manure. But taking the statement as it stands it will be seen that this improvement pays a much larger profit than any ordinary farming. It is a well-known fact among those conversant with northern husbandry that many farmers do not get five per cent. upon their capital, and that it requires a good judgment in purchasing a farm, and great skill in management to make a farm yield twelve per cent. upon the money invested. This estimate of the productiveness of the marsh was made some four years ago, after a personal examination in company with the proprietor. From a note received from him, under date of October 7, 1861, I learn that the improved land increases rather than falls off in its annual products. He says: "The gates to my flume at the foot of my reclaimed salt meadows work to my mind and well, except at times the hinges rust, and consequently do not shut close down. You spoke to me about composition hinges which would not rust. These I mean to get before another season, and then, I doubt not, all will be right. I think the product of the meadow is about three tons to the acre, annually, of a fair quality of stock hay, mostly blue top, and will spend much better, ton for ton, than the best English hay, although in market it only sells for two-thirds as much. My sales last winter were twelve dollars a ton for dyke meadow, and eighteen dollars for English. I have worked my oxen from fall to spring upon it, and they did well. Cows hold their own while feeding exclusively upon it. I have sown grass-seed on the meadow, but with very poor success. The turf is too solid and hard to allow the seed to take root. One acre I took up and cultivated. This took seed, though it soon went into blue top again. I have never top-dressed the land, and have had no occasion for so doing, as it grows a crop too large now, the most of it being lodged down. A less quantity would probably be quite as valuable. Since you saw the meadow, four years ago, I do not think I have laid out a dollar upon it, except to cut the hay crop." Mr. Bill's experience, extending over seven years, shows pretty conclusively that iron hinges are unsuitable for tide-gates. Though his hinges were very large and massive, the corrosion has hindered their free working. Much smaller copper or composition hinges, such as may be found in our large cities at ship-chandlery stores, would do the work better and last much longer. But even these will waste away under the action of salt water, and will have to be renewed after a few years. The increased productiveness of the meadow without manuring is a very gratifying result. It is probably owing to two causes, the gradual amelioration of the soil under the influence of drainage, and the annual dressings it receives in winter from the overflow of the brook that runs through it. It looks very much as if these causes would continue to operate and make three tons to the acre an average crop for an indefinite time. It certainly opens a very bright prospect to the owners of marshes, situated as this one is upon the banks of creeks and small streams. By throwing a dam across the mouth it makes still water; in

the winter floods all over the marsh, and the sediment of the stream is deposited upon the surface instead of flowing into the sea, as it otherwise would. I regard Mr. Bill's estimate of the value of the hay as much more reliable than the market price. It is a new article in the market, and like everything else new has to make its own reputation. Many have so strong a prejudice against the improvement that they would hardly be astonished to see clover and herds-grass turning back into salt hay, even after it was cut and cured. At least, if that marvel were asserted, they would be ready to say "I told you so; I knew it would turn Indian."

Mr. Bill keeps a large stock of cattle, mostly Devons, and their grades take prizes at the State and county fairs, and he knows very well what well-fed cows and oxen are. But even at the market price it makes a very handsome show for the net profit of the meadow the past season. The thirty acres produced ninety tons, which, at twelve dollars a ton, amounts to one hundred and eighty dollars. Deduct three dollars a ton for the expense of harvesting, and it leaves eight hundred and ten dollars as the net value of the crop. The large yield of grass upon this meadow explains his failure to make grass seed catch upon it. The failure, however, is of very little importance, as we shall never want to sow seed where the turf is already stocked with nutritious grasses. Upon most marshes there are vacancies enough for the seed to catch, and to occupy the places of the salt grasses as they die out. Other experiments sufficiently prove that grass seed takes rapidly where there are bare places to be occupied.

Colonel L. B. Hanks's improvement.—Colonel Hanks resides in Mystic, Connecticut, and the marsh reclaimed is at the head of tide water on Mystic river, about four miles from Long Island sound. It consists of about three acres, and the improvement was undertaken for the purpose of forming a lawn in front of a building site. The marsh lies between two hills, and there are about thirty rods of embankment lying immediately upon the edge of the river. As the river is only fed by small streams, and not subject at any time to great floods, nothing but earth-work was necessary for the dyke. As this dyke has stood for several years without repairs, and is of very easy construction, we give a very minute description of Colonel Hanks's method. The ground was first staked out where the dyke was to stand, a space six feet wide. A ditch was then cut in the middle of this staked ground, two feet wide. The surface sods were laid grass side out toward the river, forming the water front of the dyke. The muck from the ditch was piled against the sods to keep them in place. The ditch was cleaned out down to the hard pan. The next step was to fill the ditch with some kind of earth that would pack solid and make a perfect barrier to the water. Yellow loam, with a considerable mixture of clay, was taken from the adjacent upland. This was packed in solid with a rammer in successive layers as the ditch was filled up. This stratum of yellow loam was raised to within a foot of the top of the embankment, which was about two feet high. To form the inner wall, he staked off six feet from the line of the ditch already cut, and run another ditch parallel with the first, four feet wide. The sods are packed grass side out, at an angle of about forty-five degrees, forming a handsome terrace. The muck from the ditch was put between the sods and the yellow loam. The earth from the first ditch of two feet wide, and that from the second of four feet wide, with the section of loam, formed an embankment about three feet high.

The top of the embankment is finished off with gravel, and forms a pleasant walk. The ditch upon the inside is continued completely around the edge of the marsh, cutting off all water that leaches in from the adjacent upland. There are also cross ditches at suitable intervals, furnishing sufficient drainage for the whole three acres. This embankment, though strong enough for this locality, would not be sufficient if the tide rose higher, or if the river was sub-

ject to heavy floods. Every one, in making an improvement of this kind, must take into the account the pressure that will be made upon the dyke, and build accordingly. The higher the embankment the broader must be the base. Two feet in breadth to one in height will be none too much. When completed and the grass knits together, the dyke is ornamental as a terrace, and one need not suspect that it answers any useful purpose.

The tide-gate is hung perpendicularly upon two upright stems, in a flume three feet wide and ten feet long. The stems are ten feet long, and the hinge of the gate is simply a wooden windlass, swinging upon the top of these stems or posts. This is much more durable than any hinge in the water, and work better. It opens and closes with a smaller pressure of water, and is less likely to be obstructed. The flume is thoroughly bedded in yellow loam, and made tight on all sides. At each end a lattice work is put to prevent all obstructions to the gate. The gate itself is made of stout plank rabbeted together as wide as the flume is deep, and swings down upon a lip of wood fitting close at the bottom and sides of the flume.

This is, on the whole, the best pattern of a tide-gate I have ever met with. It is of simple construction, has no metal about it except the nails, is easily repaired if out of order, and, if made of oak, is very durable. About thirty rods of this dyking shut out the water from three acres. The estimated expense was seventy dollars, or two and a third dollars per rod. The land, as it stood before the improvement, was not worth twenty dollars an acre; as it now stands, it is worth two hundred. About a quarter of an acre has been planted with asparagus, and though the roots were only put out last year, it has yielded the present season a bountiful crop. The whole is capable of yielding all kinds of garden vegetables, though it is kept mainly in grass. The account of this improvement stands about thus:

Dr.	
To three acres of land	$60 00
To dyke	70 00
To flume and gate	20 00
Total	150 00

Cr.	
By three acres improved	$600 00
Expenditures	150 00
Profit	450 00

This would be called a very handsome gain upon a like capital and labor in other employments than farming.

C. T. Stanton's and J. F. Trumbull's improvement.—This marsh lies immediately north of the Stonington and New London railroad, and embraces ten or twelve acres. The marsh mud is very thin, not being more than eighteen inches in most places, and lying upon a bed of white sand and gravel. It lies so high that it was not flowed in ordinary tides, but was covered all over with salt grasses, mostly black marsh. Both parts of the marsh were generally mowed, though little value was put upon the hay except for bedding. It yielded from half a ton to a ton to the acre, according to the character of the season. A tide-gate was put in three years ago at the culvert across the railroad embankment, and the marsh was partly ditched. The culvert was not made tight, and quite too much salt water has had access to the ditches. But there has been a manifest improvement in the quality and quantity of the hay from year to year.

Seed has been sown upon a part of Mr. Trumbull's marsh, but it did not take well. Very little ditching has been done upon his part, and the improvement is rather a consequence of his neighbor's efforts than of his own. No seed has been sown upon the other part of the marsh, as the ditching is not yet finished. This marsh is very conveniently arranged for improvement, and could easily be brought up to a crop of three tons of hay to the acre. The white sand and gravel underlying the marsh would be an excellent material to spread upon the surface, and immediately upon the edge are hills of yellow loam, which would serve a still better purpose.

The Oxicoset marsh.—This improvement was undertaken about the same time with the last, and both probably were attempted in consequence of my own success. The dyked part of the marsh lies north of the road leading from Stonington to Westerly, Rhode Island. It embraces twenty acres or more, and has several owners. The dyke was already partly formed by the road. This was raised about two feet, though not so much but that the tide has swept over it occasionally in the winter. The Oxicoset is a brisk stream in winter, carrying water enough for a saw-mill. They put in a large flume and tide-gate at the bridge crossing the road, so that most of the sea water was shut out. No other efforts have been made at improvement since. No ditching has been done and no seed sown. Yet the quality and quantity of the grass have greatly improved. There has been some change in the character of the vegetation. The marsh blue top has come in, and golden rods, dock, thistles, and other upland weeds begin to make their appearance.

Several of the owners use their lots for pasturage, as they lie at a distance from their farms. I have rented about four acres from one of the proprietors the past season, and it has nearly kept two cows in good condition. This lot has cut in former years about two loads of salt hay, worth not to exceed ten dollars. The pasturage this year has been worth at least twenty dollars.

One of the best opportunities for reclaiming salt marshes in the town is at the mouth of Oxicoset brook, just below the road. Two hundred dollars spent in dyking would reclaim a hundred acres, and double their value. The piece of marsh which I have reclaimed consists of about eight acres. It lies immediately north of the Providence and Stonington railroad, and within the limits of Stonington borough. I undertook the job purely for experiment, nothing of the kind having been attempted in this neighborhood before, and all treatises upon husbandry to which I have had access throwing no light upon this subject. The effort was generally regarded as useless, and laughed at as visionary. As the land joined my garden, and would be very convenient if made productive, I determined to attempt it. I did not own the land, and did not wish to unless it could be turned into good meadow. To satisfy myself on this point, I got permission from the president of the railroad company to put in a tide-gate at the culvert across the road, which drained the marsh. Upon the inside of the road a ditch fourteen feet wide had been dug by the company when the road was made.

The ditches around the edges of the marsh next to the upland were nearly filled up with a thick growth of flags. Owing to this partial closing of the drains and the building of the road the marsh had become much less productive than formerly. In some places it was entirely bare, the grass having been killed by stagnant water. The whole product was not more than two or three tons of black marsh and onion grass, not paying for cutting. The culvert across the railroad embankment was of stone at the top, bottom, and sides, four feet in width and four feet high. A tide-gate three feet and a half in width and fifteen inches high was fitted into the culvert, and the spaces above and at the sides were made tight with stones and cement.

The whole expense of the gate and the fitting did not exceed five dollars. This work was done in November, 1855. The following year I began to notice

a change in the vegetation; dandelions, few and far between, came up and blossomed; dock and thistles also made their appearance, and occasionally a clover seed had germinated. Weeds which had grown about the edges of the marsh made their appearance everywhere in the greatest abundance. It was a safe inference that grass seed would grow where such weeds found a congenial soil, and I afterwards purchased the marsh and sowed herds grass and clover for the first time in the spring of 1856. This took very well, and some of the herds grass headed out the same season. Every one who saw the herds grass and clover actually growing was surprised at the result, but knew it would not last long. The oft-quoted proverb of reclaimed swamps turning Indian was rehearsed for my especial benefit. Believing that the operation would pay, I have subsequently cleared out the ditches encircling the marsh, carted on loam, gravel, and manure upon various parts, and sown the whole with red and white clover, herds grass, and red top. Cross ditches have been added as they seemed to be necessary, until the whole marsh is nearly covered with good upland grasses. The hay cut in 1858 was estimated at eleven tons, in 1859 at thirteen tons, in 1860 at thirteen tons, and the present season at sixteen tons. The quality of the hay is a fair average with that cut upon upland, sells for the same price, and is highly relished by cattle. So far as my observation goes, it makes flesh as rapidly and quite as good milk. The yield in 1860 was thought to be diminished by the drought. The rains in May and June were light, and the meadow suffered quite as much as upland.

It will be noticed that the average yield is nearly two tons to the acre. The crop was not of uniform excellence in all parts, as it had not received uniform treatment. While some did not yield more than a ton to the acre, other parts yielded over three tons. I had purposely experimented with various kinds of top-dressing as I had opportunity. A part was thinly covered with gravel, chiefly a pure silex; a part with yellow loam, a part with garden soil, and some with a compost of stable manure and muck taken from the ditches. In several places I applied nothing but mud taken from the broad ditch next to the rail road, a very fine deposit that has been accumulating for twenty-five years. Though no hay was weighed upon the several plots, it could be seen at a glance that the grass was better where the gravel was used than upon the undressed sod; better still upon that where the yellow loam was spread, a further improvement with the garden soil, and best with the compost. The patches dressed with the ditch mud gave an enormous growth of herds grass, quite equal to the compost. Upon a piece of about one acre and a third I tried the experiment of pasturing the grass. In the summer of 1858 and 1859 it kept two cows for nearly five months. The pasturage each year was worth twenty dollars. Thinking it would pay better in hay, it was mowed in 1860, yielding about three tons, and again the present season, yielding over four tons. I attribute the increased yield of this piece in part to the pasturing and in part to the top-dressing of compost and ditch mud which it received last fall and winter. For some reason the turf is much more solid and the grass is more thickly set. It is perhaps owing to the treading of the cattle and to the cropping of the grass.

The feeding has also a tendency to keep down the weeds. The ground is so rich that weeds grow as luxuriantly as the grass, and are certain to occupy any space that is left vacant. These will require close watching. If they are not suffered to go to seed, and the vacant places are sown with grass seed every spring, they will soon be eradicated. Another pest of these marshes are the muskrats. They throng the ditches and make their holes in the side, often undermining the banks and making holes dangerous to cattle. They feed eagerly upon the cultivated grasses, and in June and July they do considerable damage to the young crop. As they have a strong propensity to follow the beaten track, they are easily trapped either in the water or upon the land near their holes.

I have tried hoed crops upon small portions of the marsh for several years. About a half acre near the culvert has been underdrained, and produced fine crops of turnips and potatoes, with very little manure. The turnips were very fair and of good quality. The yield of potatoes was very large the first two years; less the present season, probably for want of rotation. At the upper end I have underdrained nearly as much more. The growth of corn and potatoes the first year was enormous. Last year I planted twenty-seven square rods with sugar beets and mangel-wurzel. The drills for the beets were eighteen inches apart, and for the mangels two feet apart; the roots were about a foot apart in the drill. The seed did not come up well, and there were many vacant places, but the yield of the twenty-seven rods was two hundred and twenty bushels of good, sound roots. I sold as many of the roots as I wished to at twenty-five cents a bushel, and used the rest for feeding milch cows. This yield, it will be seen, was at the rate of over sixteen hundred bushels to the acre, and the value over four hundred dollars. It is well known that the beet is a native of the shores of the Mediterranean, and that salt is extensively used in England as a specific manure for mangels. It is altogether probable that this large yield is owing to the salt which still remains in the soil in sufficient quantity to supply all the wants of the plant. Very likely these reclaimed salt marshes may prove the best land for field beets, and give a new impulse to root culture in this country. In nothing is our husbandry more deficient than in the cultivation of roots. Sugar beets and mangel-wurzels are among the best roots for milch cows, as careful experiments conducted by milkmen show. These marshes lie in the immediate vicinity of seaports and large cities, where milk brings its highest price. Other small parts of the marsh have been converted into gardens, and all plants usually grown in the vegetable garden flourish in the greatest luxuriance. The results attained in this experiment are less perfect than they would have been with more fall for drainage. The difference between high and low water at Stonington, in average tides, is less than three feet, and, owing to the stone bottom of the culvert, not more than half of this is available. The water stands in the ditches about eighteen inches from the surface. This is an embarrassment that few improvers will labor under, for the average difference between high and low water is greater in most places, frequently reaching five feet, which is all that is desirable. Further experiments may show that three feet drainage is sufficient to bring out the highest productiveness of the land.

In making a statement of the pecuniary success of the experiment, it would appear that the cost of the land was about eight hundred dollars, taking that only which is now in grass. This is much above the common price of such land, owing to the location within borough limits. The estimated value of the crop for this year is twelve dollars a ton for the hay, or one hundred and ninety-two dollars. I put the value of the muck gathered from the ditches, and the after feed, against the cost of top-dressing the land. This would show the land to be worth four hundred dollars an acre, estimating the interest at six per cent., or that it paid an interest of twenty-four per cent. on the original investment of eight hundred dollars. With all allowance for contingencies, the result is sufficiently encouraging to induce the owners of these lands to reclaim them.

The improvements here put upon record clearly establish the following positions:

1. That these salt marshes can be reclaimed. In every instance there has been a great increase in the quantity of grass grown, and improvement in its quality. There is nothing peculiar in the circumstances or location of these marshes to make them an exception to the general rule.

2. That the work can be done economically. The impression is common among those who have not looked at the facts that the improvements cost more than they come to. These cases show without exception that there has been

a decided gain above the cost of dyking and drainage, and in most of these a very large gain.

3. That thoroughness in the work is the best policy. The success is most decided and the gain the largest where capital has been freely used upon the dyke and ditches.

4. That the larger the marsh the less the cost per acre of improving it. A single tide-gate and embankment will serve for a hundred acres as well as for five or ten.

There is every encouragement to form companies and raise a large capital to reclaim large marshes, where they are beyond the means of a single individual. If rightly managed they could not fail to be far more productive than the capital invested in ordinary farming, and to rank with the most successful business enterprises. We who have made these experiments look forward with confidence to the time when these marine wastes shall be redeemed; when "a salt land shall be inhabited," and the cattle upon a thousand hills shall find their winter supplies in the products of these meadows, and millions of dollars be thus added to the national wealth.

FOOD.

QUALITIES AND CHANGES REQUISITE TO HEALTH AND STRENGTH.

BY PROFESSOR L. C. LOOMIS, A. M.

In discussing this subject we shall consider—

1. What the human system requires and what nature supplies;
2. The changes required by the change of seasons; and
3. Unripe and decaying food.

The two prime physical necessities of man are food and clothing. These vary chiefly according to the circumstances of latitude or, what is equivalent, temperature.

Without entering upon the question whether the earth was made to correspond in its changes, temperature, and productions to the nature and wants of man, or man to the condition of the earth, it is sufficient for us to know that not only does such adaptation exist, but that the measure of its perfection is the measure of our physical perfection, and, consequently, of our physical enjoyment.

To a large extent this harmony already exists in the natural condition of the lower orders of animals. Food and clothing are with them what nature provides. This is ordinarily sufficient for their life and comfort; but when it fails they are endowed with no intelligence or power to create other supplies, or to arrest or avoid the death that must of necessity follow.

In the case of man, as he is designed to inhabit all portions of the earth, from the frigid to the ultra torrid, he is designedly adapted partially to all climates and fully to none, the completion of this adaptation as may be required being left to his own higher intelligence. To a limited extent he is made the judge of what, in every variety of season and circumstances, will contribute to his health and comfort. It is reason enough for an animal to eat that it has an appetite and finds what will appease it, and, as an almost unvarying law, such food is adapted to and was intended for that animal. Its taste, being circumscribed to a limited number of qualities, is exact and decisive. With man this general law of nature is subject to certain limitations, upon the correctness of our deter-

mination of which depends much of our physical comfort and enjoyment. That our taste does not reject a substance does not constitute a sufficient reason that it is proper food.

In the animal economy there are three essential sources of demand for new material:

1. To restore the loss consequent upon the natural wear.
2. For the production of strength.
3. For maintaining vital warmth.

But though these separate wants are indicated indiscriminately by the sensation of hunger, yet so distinct are they that those substances which may most fully respond to one may not afford any element for the others.

Muscular effort involves the expenditure of nervous force and of the substance of the muscle itself, and consequently necessitates a restoration of each. The abstraction of heat requires a new supply of fuel. But that which may yield heat in the animal system may yield neither muscle nor nervous energy.

A substance to be nutritious must yield to the digestive forces some element that is needed in the system. It may and in a few instances does several; but if it bestows none, then it is absolutely useless in the animal economy. On the other hand, any substance that readily supplies the system with whatever is being continually consumed becomes of essential value, even though, from its inability to supply all the demands, it cannot sustain life.

The demands of the system being numerous and variable, and each article of food yielding but a few specific elements, it follows not only that there must be some variety, but that, *to be productive of health and strength, this variation must correspond precisely to the fluctuating condition of the system.*

But as the wear of the frame as well as the expenditure of the strength and nerve power in any individual case may be assumed as quite uniform, and the demand in these respects nearly constant, while every month brings a temperature unlike the preceding, it is manifest that the chief changes required in nutrition are those to adapt the system to the great annual change of temperature.

I.—OF THE TEMPERATURE OF THE HUMAN BODY.

While the external temperature varies more than a hundred degrees, the thermometer indicates that in health the blood keeps invariably at the same degree of heat. Neither the prostrating heat of summer nor the benumbing cold of winter reaches the animal, vital warmth. This fact, which is more or less well known, is generally accounted for upon the vague but erroneous impression that a living body has some mysterious power of preventing itself from losing its heat. The power of a living body to generate heat or to preserve it is no greater nor more mysterious than that of a stove. When the fire is once started, each will keep warm so long as there is a supply of fuel and no longer. The one is combustion with flame; the other, combustion without flame. Chemically considered, the processes are not only similar, but identical; the material consumed, the chemical action, and the results of the combustion being the same. Heat can no more be generated in the animate body without the consumption of fuel than in the inanimate. The living organization must, then, in the cold season consume, and therefore by some means be supplied with, a large amount of fuel or heat-generating food, in addition to that needful for sustaining health and strength in the warm season.

Having, then, the facts that the wants of the system in respect to the calorific or heating element are variable, and that the various articles of nutrition are equally or more variable in their supply, it will be readily inferred that these inequalities are intended the one to meet the other; that calorific or warming food is intended for winter, and non-calorific food for summer; and not only

so, but that *the heat-producing food in the season of already oppressive warmth must prove injurious, and that the non-calorific must be exhaustive and insufficient in the winter.*

But before we can properly enter upon a consideration of the changes in food required by the change of temperature, it will be necessary to examine the chemical composition of food in general.

ANALYSIS OF FOOD.

The ultimate elements of which food is mainly composed are oxygen, hydrogen, carbon, and nitrogen.

Nitrogen enters largely into muscles and the tissues, and is therefore expended in muscular effort. Carbon is the great source of animal heat, and is consequently rapidly expended in low temperatures. Hydrogen is a main constituent of all fluids, and must, therefore, be abundantly supplied in high temperatures to sustain perspiration. Oxygen enters into almost everything generally, and must therefore be liberally furnished.

The assimilative power, however, of animal life is incapable of direct action upon these simple elements. In their simple or uncombined condition, so far from being nutritious, they are either inert or noxious. They must, first, by the action of the vegetative forces, be combined into certain compounds, which, when taken into the human system, yield to its action and afford nutrition. In considering food, therefore, we do not regard so much the simple elements as these primary compounds which are denominated proximate elements. These, which may be either animal or vegetable, have a fixed chemical composition and character, which give to every article of food a definite scientific basis upon which to rest investigation and reasoning.

These are of two classes, the carboniferous and the nitrogenous, the composition of which is shown by the following table:

The carboniferous is composed of—	
Carbon,	Oxygen.
Hydrogen,	
The nitrogenous is composed of—	
Carbon,	Oxygen,
Hydrogen,	Nitrogen.

The following are the most common and important substances in each class:

The carboniferous, four—	
Wood,	Starch,
Gum,	Sugar, (cane.)
The nitrogenous, three—	
Albumen,	Casein.
Fibrin,	

The carboniferous, wood, gum, starch, and sugar, although having so little resemblance, have a most remarkable uniformity of composition. In fact, three of them are composed of precisely the same elements and in the same proportions, and the fourth differs very slightly, thus:

Wood, gum, and starch are composed each of—	
12 parts carbon,	10 parts oxygen.
10 parts hydrogen,	
Cane sugar is composed of—	
12 parts carbon,	11 parts oxygen.
11 parts hydrogen,	

Though the elements of the carboniferous substances are the same, wood

yields not at all, and gum but slightly, to the digestion process, leaving starch and sugar as the two principal sources of nutrition in this class.

The composition of the nitrogenous proximates is identical in all, as follows:

Albumen, fibrin, and casein are each composed of—

40 parts carbon,	12 parts oxygen,
31 parts hydrogen,	5 parts nitrogen.

Having thus determined the proportion of the simple elements in the proximate, the only additional data required for an absolute determination of the nutritive power of any substance is the percentage of proximates which it contains.

1. The following table shows the per cent. in some of the most important vegetables:

	Starch.	Sugar.	Albumen.
Wheat	60	5	30
Rye	60	3	12
Corn	80	1	10
Potatoes	15	0	4
Rice	82	0	0

From which it is seen that rice is highest in the amount of starch and lowest in albumen, while wheat, which has a heavy per cent. of starch, is first in albumen.

From the above we deduce the following table, showing the proportionate weight of the elements in 1,000 pounds of nutrition:

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.
Wheat	508	67	326	98
Rye	485	64	389	62
Corn	477	64	415	44
Potatoes	498	65	364	72
Rice	492	62	446	..

In which, with the exception of rice, we are struck with the remarkable uniformity of the proportions of carbon and hydrogen, the one being not far from 500, the other from 65. The proportions of oxygen and nitrogen are somewhat more variable.

If we now analyse the substances that constitute the human frame, we may be able to institute a comparison between the actual wants of the system and the actual supplies offered in the above articles.

As bone is slow of growth and decomposition, and therefore correspondingly feeble in its nutritive action, we shall omit it as unimportant to our present investigation.

The remainder of the body is chiefly composed of muscular fibre and membranous tissues.

Proceeding in the analysis of animal substances as previously in vegetable, we find three animal proximate elements quite similar to the vegetable—fibrin, albumen, and gelatin. Muscle is almost wholly fibrin; tendons and the membranes gelatin.

The composition of these is as follows:

Fibrin and albumen are composed each of—

40 parts carbon,	12 parts oxygen,
31 parts hydrogen,	5 parts nitrogen,

being the same as vegetable fibrin and albumen.

Gelatin is composed of—

33 parts carbon,	15 parts oxygen,
30 parts hydrogen,	6 parts nitrogen.

Reducing these proportions to the same basis as before for the purpose of comparison, we have the following:

Relative weight of elements in 1,000 pounds of animal fibre:

Carbon, 549 pounds.	Oxygen, 219 pounds.
Hydrogen, 70 pounds.	Nitrogen, 160 pounds.

That is, of 1,000 pounds of muscle and membrane, the chief components of the body, 549 pounds are carbon, 70 hydrogen, 219 oxygen, and 160 nitrogen. Now, it is evident that if these are component parts of the body to this amount, food must supply them to this amount, or there can neither be health nor strength. Let us make the comparison:

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.
Animal fibre has	549	70	219	160
Wheat has	508	67	326	98
	— 41	— 3	+ 107	— 62

From these figures it appears that wheat furnishes almost exact supplies of carbon and hydrogen, a large surplus of oxygen, but has a marked deficiency in nitrogen. Again:

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.
Animal fibre has	549	70	219	160
Rye has	485	64	389	62
	— 64	— 6	+ 170	— 98

Here the deficiencies and the excess, in every instance, are greater than before, and therefore rye is less able than wheat to satisfy the wants of the system. Expressing these deficiencies and excesses in decimals, we find in wheat a deficiency in carbon of only 8 per cent., in hydrogen of only 4 per cent., but in nitrogen of 39 per cent.; of oxygen there is a surplus of 50 per cent. In rye the deficiency in carbon is 12 per cent., in hydrogen 9 per cent., in nitrogen 62 per cent., while there is an excess of oxygen of 77 per cent. Comparing the others in the same manner, we have the following statement:

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.
	Deficiency.	*Deficiency.*	*Excess.*	*Deficiency.*
Wheat	.08	.04	.50	.39
Rye	.12	.09	.70	.61
Corn	.13	.09	.89	.83
Potatoes	.10	.07	.66	.55
Rice	.11	.12	1.04	.00

This table gives several valuable and practical results.

1st. We observe that there is no noticeable deficiency in either carbon or hydrogen, all of these vegetables furnishing nearly, if not quite, the requisite amount.

2d. They all yield a large excess of oxygen.

3d. But all have a material deficiency in nitrogen, only one having a supply of even 50 per cent.

4th. As we are considering the composition of muscle, and consequently the growth of children and the strength of the adult, it appears *that these vegetables are not sufficient food for either class.* They can produce neither material for the one nor strength for the other. There can be no muscle nor membrane without 160 parts nitrogen in a thousand. Wheat furnishes a little more than half that amount, potatoes but 45 per cent., rye but 38 per cent., corn but 27 per cent., and rice little or none.

5th. As all furnish nearly or quite a supply of carbon, hydrogen, and oxygen, it is evident that the vegetables having in addition the largest amount of nitrogen will possess the greatest nutrient value. Thus, for the laborer wheat is by far the most valuable vegetable food, next to it ranks the potato, next rye, next corn, and last rice.

6th. Children may live and grow and a man may labor upon vegetable food alone; but if good healthy muscle must have a certain amount of nitrogen, as it always must, and if these best of vegetables average but about one-third of that amount, (34 per cent.,) it is conclusive that vegetable food can make neither child nor man strong and energetic.

To the pertinent inquiry, what additional food is needed? the obvious answer is, something more highly nitrogenized.

Let us examine some other of the most common and valuable articles of diet. The elements, carbon, hydrogen, oxygen, and nitrogen, are expressed by their initials in the following list, which indicates what of these elements enter into the several articles named:

Fruit, C, H, O.	Milk, C, H, O, N.
Fat meat, C, H, O.	Lean meat, C, H, O, N.
Butter, C, H, O.	

From this it appears that neither fruit, fat meat, nor butter, have nitrogen. Of milk, after the abstraction of the water, nearly one-half is albumen and casein, having the same per cent. of nitrogen as animal fibre, or 160 pounds in the 1,000, which large amount gives the philosophy of *bread and milk*, and why children thrive so well upon this staple nursery dish. Cheese, which is nearly pure casein, has the same large per cent. of nitrogen, or 160 pounds in the 1,000, and thus explains the philosophy of *bread and cheese*. Meat (lean) of the various marketable kinds, being nearly all fibrin, and having the same chemical constitution, has sixteen per cent. nitrogen, the same that we require.

Summing up these facts, we find that in the growth of our bodies and in the production of strength we require 160 pounds nitrogen in a thousand. Fruit has none, fat meat none, butter none, rice none, corn 44, rye 62, potatoes 72, wheat 98, milk 160, cheese 160, meat 160 pounds. Milk or meat seem, therefore, an indispensable element of food in the animal economy. Possessing different chemical elements from vegetables, an increased amount of the latter cannot make good a deficiency of the former. It appears, also, that lean meat is one of the most direct sources of supply for the muscle, and is therefore one of the best and cheapest foods for the laborer. The same is true of growing youth. From the age of five to fifteen the chief business of youth is to grow. They have to manufacture a hundred pounds more or less of bone muscle and tissue. For this they demand milk and meat; nothing else is as good. To be strong and healthy, they must have the one or the other in good supplies. Not only boys but girls also. The attempt to grow up a healthy, well-developed, and energetic girl upon cake, pastry, biscuit, hot rolls, and similar diet, will prove as futile as she will weak and useless.

If we would have nature bestow upon our daughters forms of health and beauty, and upon our sons those of dignity and strength, and upon ourselves power and endurance, we must put at her disposal the material wherewith alone she undertakes its accomplishment.

II.—OF THE CHANGES IN FOOD REQUIRED BY THE CHANGE OF SEASONS.

Thus far our inquiries in regard to food have been limited to the question of the ordinary and constant demand for healthful growth and action, and to the proper supply. We are now prepared to enter upon the consideration of the extraordinary and fluctuating demands arising from the change of seasons.

The great heat-producing agent in the animal economy is carbon, aided somewhat by hydrogen. In the union of these elements with oxygen heat is evolved, sometimes with a flame, as in the case of burning wood, and sometimes without, as in the case of most chemical action. What, therefore, is needed in the animal economy for the production of heat is a supply of carbon, hydrogen, and oxygen.

Recurring to the former table of the proportion supplied by vegetables, we find an average deficiency of ten per cent. carbon, eight hydrogen, and an excess of seventy-seven in oxygen.

Having thus already a large amount of oxygen in the system unexpended, we have now to look for substances containing a relative excess of carbon and hydrogen.

Let us examine the fatty substances. The proximate elements in the oils, lard, beef, and mutton suet, are oleine, stearine, and margarin, of which the proportions are:

	Carbon.	Hydrogen.	Oxygen.
Margarin	46	46	7
Stearine	47	47	6
Oleine	46	44	8

The different degrees of hardness in different fatty substances arises from variation of proportion in the mixture, a preponderance of stearine giving more solidity, and of oleine an opposite quality. But whatever may be the proportion, the elements are so slightly varied as to make no appreciable difference in our present estimate; and we may hence take the average as the composition of oils, butter, fat meat, suet, and pork. This gives in fatty substances 46 carbon, 46 hydrogen, 7 oxygen; reduced to weight, carbon 723, hydrogen 122, oxygen 155 pounds in a thousand.

Having already 168 pounds excess of oxygen in the previous nutrition, we have, as fuel, 723 pounds carbon, 122 hydrogen, and 323 oxygen.

To consume this amount of carbon and hydrogen requires about 2,000 pounds of oxygen, a quantity much greater than ordinary food can supply.

Respiration here meets nutrition and restores the equilibrium. The air drawn into the lungs freely imparts its oxygen, which, combining with the carbon and hydrogen, forms carbonic acid and water, to be expired in turn—an interchange of elements too familiarly known to need further remark.

The facts, then, thus far seem to be:

1st. That fatty substances are the great source of animal heat.

2d. They are, properly speaking, *fuel* rather than *food*.

3d. The demand being suspended in summer, their presence in the system can only be detrimental, either from over heat, if the combustion necessary to their elimination goes on, or from debility of the surcharged organs, if it does not.

These deductions of science are fully corroborated by the indications of nature.

1st. As a general law, fat accumulates in animals in the fall, is consumed in winter, leaving them thin or lean on the approach of warm weather.

2d. The time of man's laying in his store of winter subsistence is precisely that of the fatness of animals.

3d. The appetite or relish for animal food increases in the fall, continues during winter, and passes away on the approach of summer.

4th. Milk and butter are most abundant, and of best quality, in the fall, the butter of spring being distasteful, and the milk mostly needed to supply the young of the animals.

From these considerations we conclude:

1st. That in cold weather fat is not only a proper but a necessary article of food.

2d. That lean meat and vegetables having a much inferior heat-sustaining

power, *a due amount of fat is the cheapest food for winter, especially for those much exposed to cold.*

3d. On the return of summer its use should be discontinued, as being both needless and injurious.

4th. In all inflammatory diseases, milk, butter, cakes and pastry made with butter or lard, and fat meats, having, from their heating powers, a tendency to increase the inflammation, should be entirely discarded.

Having examined the requirements of food necessary to enable the system to meet the increasing cold, we are the better prepared to understand what may be necessary to prepare the system to meet the alternation of heat.

Whenever the temperature daily increases or decreases, so that the system is more and more taxed to maintain its exact equilibrium, additional material will be required, of one kind or other, as the case may be, to sustain this new expenditure of vital force. In the autumn we found a special supply and a correspondent appetite. In spring we may justly look for similar indications in both external nature and ourselves. As the one was food of calorific properties, so the other should be food of a cooling nature.

The productions of spring and summer are salads, fruits, vegetables, and the cereals, of which the two latter classes ripen so late as to bring their consumption in the cool rather than the warm season, leaving as the productions of the early summer only the salads and fruits.

Salads can hardly be considered as nutritious productions, but as they are the first departure from winter food, and are, therefore, the precursor of the more general change to follow, they cannot be omitted. We shall include under this term what are specially denominated *greens*, as well as salads proper, both being the early shoots or foliage of any innoxious vegetable—eaten raw, if tender and tasteless; otherwise boiled, to soften its texture and remove its unpalatable juices.

Salads consist of little more than uncompacted cellulose, the various oils and acids peculiar to each plant not yet having been to any extent elaborated. The first thing to be remarked of the whole class of salads is, that they are seldom eaten without vinegar. Indeed, it is questionable whether the vinegar is not essential to a salad—whether most salads without the vinegar would not be rejected by the taste. At all events, taking salads as universal taste constitutes them, acid must be considered as a constituent. We have, then, cellulose, acid, and not unfrequently a little sugar added—a compound so nearly resembling *fruit* as to lead to *its* examination before proceeding further.

ANALYSIS OF FRUIT.

The most of our common garden and orchard fruits are composed of nearly the same constituents—a little woody fibre, more or less sugar, and several acids, the most common of which are the malic, the citric, and the tartaric. Two or more of these acids are usually found in every fruit, though one preponderates, giving the fruit its peculiar flavor; as the malic in apples and pears, the citric in currants.

At different stages of the growth of the fruit, these various substances are in different proportions, the woody fibre or cellulose usually being the most abundant.

It has been previously mentioned that woody fibre differs but slightly from sugar, so that it will not be difficult to comprehend the fact that, by the action of the acid of a fruit, what is cellulose at one time may be found to be sugar at another.

"Previous to maturity, fruits are formed of a compact cellular tissue, containing the elements of woody fibre, and filled with a liquid containing very little sugar, a gummy substance, and a large quantity of free acid. During

maturation a part of the acid disappears by the action of oxygen of the air, the cellulose tissue diminishes, and the proportion of sugar increases, insomuch that instead of hard, woody, acrid fruits, we obtain, if the maturation has been complete, fruits that yield a sweet, sirupy juice."—*Turner.*

The chief elements of ripe fruits, therefore, appear to be water, gum, sugar, and acids, of which the only one requiring our attention is the acid; sugar, gum, and wood having been previously considered.

In medicine the vegetable acids are included among the refrigerants; that is, as possessing in an eminent degree the properties of counteracting the heat of the system. There is much diversity of opinion among writers as to the manner in which this is accomplished and as to the chemical changes that occur in connexion, but all agree that the effect of acids in weak dilutions is to reduce animal heat.

Reasoning *a priori* from this general fact, we might have drawn a fair probability that the spring productions would possess or require acids.

We here find the philosophy of salads. The temperature is daily increasing; the system requires additional means of resistance; nature proceeds to the growth of cooling acid fruits. But before juices can be secreted the structure of stalk and leaf must be erected. At this point we seize the new growth of cellulose and add to it the acid, which would appear in due time. A salad is, therefore, a sort of *impromptu* fruit, having the cellulose of this year and the acid of last. Were the acid unessential, and the cellulose all that our systems demanded, the taste would be appeased by it alone, and there would be no more demand for vinegar with the salad than for butter or sugar.

In the ripened fruit we find all parts fully harmonized, not only to the taste but to the season. The water quenches thirst and supplies material for increasing perspiration; the sugar is nutritive and imparts an agreeable taste to the whole; the acid dissolves the cellulose and reacts beneficially throughout the system.

Summing up these facts, we find—

1. In the new supplies of food which the spring and summer bring the calorific element is nearly or wholly wanting.

2. In the same manner that we found a heating element added to nutrition proper on the approach of cold weather do we find a cooling added on the approach of warm. This is fruits, and particularly their acids; from which we conclude,

3. That ripe fruits are not only the most healthful of all food in summer, *but actual conservators of health, and necessary in the economy of nature.*

But if such is the hygienic character of fruit, whence arises the general opinion of its injurious effects, especially in sickly seasons? and what shall be said of those well-authenticated facts of fatal results having been induced by them in the extreme summer weather, and of the generally untoward effects attendant upon a free use of the earlier kinds, particularly strawberries, apples, pears, and melons?

So far from attempting to deny that such results do frequently follow eating these fruits, we not only admit that the fruit is the direct cause, but that, under the circumstances usually accompanying those particular cases, it is almost impossible that any other result should ensue. This question, or fact rather, of the injurious effects of early fruits demands our careful consideration.

It is alleged that in certain cases fruits are injurious, whereas our considerations above led to the conclusion that they are not only harmless but positively beneficial.

We are, therefore, brought directly to the considerations whether fruits are always uniform in their action, and whether they may not be, and are not, in some cases hurtful.

Before any adverse conclusion can be drawn, two conditions must be fully

shown; first, that the fruit was fully ripe; and second, that it had not commenced to decay. An examination of the chemical condition of fruits and food in general in these respects may serve to elucidate the points at issue.

UNRIPE FRUITS.

We have before seen that during growth a fruit consists of cellulose and certain acids. *Ripening consists of a process by which, after the fruit has attained its full size, the chemical condition of the elements is changed.*

"In the ripening of fleshy fruits we must distinguish two operations, viz: that of growth and development, and the ripening itself.

"Fleshy fruits and several kinds of berries acquire while ripening a much greater proportion of sugar than they contained before maturity, although full grown. Ripe fruits have not an acid taste because they contain a larger quantity of basis, by which they are saturated, and not because they are disguised by sugar."—*Mulder.*

"At the moment of ripening, the acids of the fruits are partially saturated, and form salts of lime or potash."—*Fremy.*

It thus appears that, chemically, *an unripe and a ripe fruit are radically diverse.* The unripe has cellulose and acid. In the stomach the cellulose, if well compacted, as in most fruits, remains indigestible, while the acid, being in excess and unattempered by the alkalies, acts as an irritant. That any considerable quantity of such material can be received into the stomach and not result injuriously is certainly beyond any justifiable expectation. We could expect nothing else.

It is not the occasional eating of a green apple by children which demands our attention, but the general introduction of unripe fruits into cookery as an article of food. Their harsh and acrid taste is usually a sufficient guarantee against their being eaten by either children or adults till the ripening is nearly perfected, but when it is "disguised by sugar," or concealed by combination so that it is no longer offensively detected by the taste, they are fancied to be harmless. It should, however, be fully understood that cooking a green fruit does not ripen it. Boiled, stewed, or baked, and the more the worse, as it still more concentrates the acids, it is nothing more nor less than an unripe fruit.

Such compounds of green currants, apples, huckleberries, gooseberries, grapes, pears, and the like, have no relationship to those luscious, agreeable, and healthful products which these fruits offer to us in full maturity. Whatever evil effects may follow are with much greater propriety chargeable to the temerity of eating such material than to the fruits themselves.

It is further to be remarked that each species of fruit has its own time for ripening, not always and, indeed, seldom coincident with full growth or dropping. Some ripen and decay while yet upon the tree, others fall at the precise time of maturation, while many remain for weeks or months after leaving the parent tree in the slow process of ripening.

Certain species of winter apples are said not to keep well; that is, they ripen in the early winter, and like all juicy fruits pass at once from perfection to decay. Other species ripen more slowly and are not perfect till mid-winter, while a few are yet unripe till nearly or quite spring. But at some time each fruit reaches its perfection, and at that time *and that only* does it possess its beneficial qualities. Both before and after it is more or less noxious; before, from its indigestible cellulose and its concentrated acids; after, from its decay.

DECAYING FOOD.

All vegetable and animal productions have a tendency to decomposition. This decomposition may be partial by returning to the proximate elements, or total by returning to its ultimate. Thus, when an apple decays its juice passes

first through the sugar fermentation and afterward through the vinous, and remains as vinegar; this is a partial decomposition. But when a potato decays, it passes at once into utter dissolution. The peculiarity of these decompositions which demands our attention is, its contagious nature, the decomposition of one particle being communicated to the adjoining ones, and by these to the next, and so onward. The fermentation of yeast is such a decomposition. When mixed with dough it communicates its action throughout the mass, and if the fermentation is allowed to continue the dough becomes first sour and at last entirely decomposed. This power of assimilation by contact is quite universal in all varieties of decay, both in vegetable and animal substances. Even living substances are affected by contact.

Many diseases are known to arise from the reception into the lungs of decaying vegetable matter in the air. Drinking stagnant water, that is, water filled with decaying vegetable and animal substance, begets the most malignant diseases. Establishments in cities which emit offensive effluvia, such as slaughter houses, stables, glue and soap manufactories, are always brooding nests of contagion. Nor is it very material whether the decaying matter be introduced by air into the lungs, or by food into the stomach. Contact is as effectual in one case as the other—contact of the decaying with the living fluids and membranes—and decomposition as readily communicated. In the one instance the decay is nearly complete, in the other but just commenced, but this is a difference in degree rather than of kind. In either a small amount of material is sufficient to transmit the tendency to disorganization. The less juicy vegetables manifest their first change by what is denominated *wilting*. In this condition the nutritious qualities are much injured and the indigestibility greatly increased.

The more juicy fruits spoil or decay with much greater rapidity, and the decomposition is more complete. Peas and cucumbers *wilt*, but strawberries, tomatoes, and similar fruits decay. The one may not be as injurious as the other, but both are noxious, and may engender a chemical condition very difficult to control.

Now it is to be observed that but a small portion of the ordinary supplies of our large cities is in a proper condition when offered in market. The desire of securing the high prices of the earliest products induces the gathering of the first growth while yet unripe, and of that which remains till fully matured the succulent fruits and vegetables commence decay before reaching the termination of the distances large quantities are transported. Eaten freely by those who deem anything from the country healthful, to their surprise it is found to be detrimental, till after repeated trials they arrive reluctantly at the conclusion that meats are safer food in summer than vegetables. Nor is it to be denied that too frequently this conclusion is just.

Here lies the whole trouble: the vegetables of the city are not the vegetables of the country. The latter are usually gathered and eaten at the time of their perfection, the former before or after; in either of which cases their chemical constitution, as we have seen, is not that of the ripened fruit: the one is digestible, nutritious, and cooling; the other either acrid and irritating, or indigestible and poisonous.

These chemical facts fully explain all the results attendant upon eating fruit and vegetables. When eaten fresh gathered in the country, they fully answer the character we have assigned them as being the most healthful and beneficia of summer food; in the city, after leagues of transportation under a burning sun, and hours of storage in addition, they are well adapted to justify the common suspicion as to their sanitary qualities.

The countryman, as he gathers the full grown and luscious products of his own fields, may know he is receiving for himself and those he provides for

gifts from the goddess of health. The citizen, as he returns from the market, may well reflect whether the goddess of health or traffic presides in that mart.

Though the solution of the whole case is so simple, the remedy appears far less so.

It is difficult to get sufficient supplies of proper vegetable food for a densely populated city; so difficult, in fact, that we shall do a better service by indicating what is our best means of meeting the case as it stands than of indicating its remedy:

1. It is better to do without vegetables altogether than to use them in any other than their prime condition.

2. No intelligent provider for a household ought ever to bring into his home fruits, berries, or vegetables green, unripe, over-ripe, wilted, or decayed.

3. Produce purchased in market because it is cheap or under price is culpable economy; it is paying half price for what is not only worthless but worse.

4. Salads, lettuce, kale, cucumbers, peas, and green corn wilt under any circumstances in a few hours, and should therefore be eaten the same day gathered. Peas should be picked, shelled, and cooked immediately.

5. Berries, melons, tomatoes, and all similar juicy fruits, having but a brief interim between the unripe and decaying condition, are always just objects of suspicion and intelligent examination.

The decomposition of animal substances is still more rapid, complete, and offensive to the system. Decaying meats taken into the stomach cannot fail to act more or less directly and decisively, and it will be good fortune if immediate nausea or other violent action remove them from the system with no greater or more permanent disturbance.

The meats most liable to taint are those transported a considerable distance, such as fish, oysters, and chickens. Much also of the salted beef and pork in market in summer is in similar condition, having hung in the stall till it was unsalable and unwholesome, and then been salted as the only means of prolonging its term of probation.

Decay in animal fibre is more contagious and more readily transmitted to living animals than decay in vegetables, though the effect is not unfrequently less immediate. An indigestible fruit may cause serious disturbance in the stomach, attended with violent pain, while the chemical action of decomposing animal fibre may pass the stomach and only show its effect in the blood, preparing the system for some deep-seated, malignant, resistless, and often fatal disease.

In concluding our observations upon food, a brief reference to milk, tea, and coffee seems appropriate.

Milk contains in solution not only a due proportion of carbon, hydrogen, oxygen, and nitrogen, as before mentioned, but all the other elements necessary for the construction of bone, nerve, &c., and is hence always a proper food in all circumstances of health.

Tea derives its beneficial qualities not from its direct supply of nutrition, but from its affording a peculiar substance called theine, the effect of which in the system is to *diminish the waste*, thus making less food necessary. Tea thus has a positive economic value, not as supplying but as saving nutriment.

Coffee, though of a taste so little allied to tea, derives its value in precisely the same manner and from nearly the same substances. Its value and effect in the system are therefore the same as those stated above. It is hence evident that milk, tea, and coffee are valuable articles of food under all conditions of temperature.

CHARACTER, CULTIVATION, AND USE OF THE LUPINE.

BY LOUIS SCHADE, WASHINGTON, D. C.

DURING my visit to Europe, particularly to Prussia, in the latter part of the summer of 1861, my attention was called, by the kind assistance of some of the higher officials of the Prussian agricultural department, amongst whom I mention especially the name of the œconomic commissarius, (commissary of economy,) M. Krocker, at Berlin, to the extensive cultivation of a plant which has made quite a revolution in agricultural affairs in that part of the world. This plant is the lupine, known in this country as a garden flower. From trials made during the last ten years in northern Germany it was shown that it not only makes excellent fodder for cattle, especially for sheep, but that it also has the most astonishing fertilizing power if used as green manure. It is now cultivated extensively, and, as I was told by Prussian agriculturists, it may be said that farming in that country has entered into a new stage, so great are the extraordinary benefits afforded by this plant. It will grow on the poorest soil unassumingly, and without pretensions to laborious cultivation. Large estates which, on account of light, sandy or exhausted lands were almost worthless, are now, by the cultivation of the lupine, producing in value as much as those of the best soil. Where formerly, from want of meadows, a hundred sheep were kept, a thousand will now get through the winter without trouble by using the lupine as fodder. Even the quantity of wool shorn will increase from eight to ten per cent., as the sheep are very fond of this nourishing plant and its seed.

It is remarkable that the lupine, with all the benefits it bestows, should have been forgotten for centuries. The ancient Romans cultivated it just for the above-mentioned reasons. This is another proof that, if we may excel in machinery and other scientific inventions at the present time, the ancient people were not much, if at all, behind us in the art of cultivating the soil. Theophrastus, (who lived from 370–286, before Christ,) speaks of the lupine in his *History of Plants.* Marcus Portius Cato Censorius (232–147, before Christ,) mentions the same in his work on agriculture, and in the *XII libri de re rustica* of Columella, and also in Pliny, we find an explicit statement concerning its cultivation and use. They say that "the lupine will grow without manure on exhausted soil, also on red clay and on coarse, especially ferruginous sand, whilst lime soil, and particularly wet lands, will not agree with it. The lupine serves especially as green manure," &c.

Being firmly convinced that the lupine, if introduced by our farmers into this country, will be a God-send to all those that have either light, sandy, or exhausted soil, I consider it a matter of the highest importance that some trials with the same should be made, especially on the sand lands of New Jersey and the worn-out lands in Pennsylvania, Maryland, Kentucky, and other States; particularly on the so-called "old fields," exhausted by an extensive and constant cultivation of tobacco, the lupine will prove an excellent and a very cheap manure. Guano is not only high priced but, as it has more stimulating than fertilizing qualities, well enough to be employed with advantage on good, not worn-out clay soil; it is even injurious on lands of the above description.

The following facts respecting the character, cultivation, and use of the lupine I have collected partly from personal observations, partly extracted from reliable writings recommended for that purpose by the above-mentioned member of the Prussian (agricultural) administration.

Of the eighty-three different species of the lupine only three have, thus far, been used for agricultural purposes, namely, the yellow lupine, (*Lupinus luteus;*) the blue lupine, (*Lupinus angustifolius;*) and the white lupine, (*Lupinus albus* or *termis.*) Of these three, the yellow lupine is considered the most useful, though the blue lupine is also extensively cultivated. The white lupine we find especially in southern France, in the triangle between Valence, Lyons, and Grenoble. The principal objections which German agriculturists entertain against the white lupine consist in its being more a southern plant, and not always getting ripe in higher latitudes; and then it cannot be used as fodder, as it causes symptoms of disease amongst the cattle. Its cultivation in northern Germany has, therefore, entirely been abandoned. The yellow lupine is the best adapted to be cultivated in this country. It is the same which we have been growing in our gardens, being the only one of the eighty-three species the flower of which has a sweet, honey smell. The blue lupine is also useful, and it would be well if some trials with it should be made; the more so, as its seed ripens more equally than that of the yellow lupine; for if the beans of the lupine are not dry, or even if some green beans are amongst them, they are all apt to get mouldy, becoming entirely useless either for feeding or seed. The transport of this seed across the ocean will, therefore, on account of the dampness existing on board of vessels, be no easy matter, and the winter months should be selected as the best time. Besides, great care ought to be taken to buy the best ripened fruit; for as the lupine culture is entirely unknown in this country, it will, therefore, require considerable encouragement at the start, otherwise its introduction will be postponed, notwithstanding the great benefits which, particularly our eastern, farmers will derive therefrom. I repeat again that the greatest pains must be taken in getting good seed. None but perfectly dry seed ought to be bought. Any other will not grow.

SOIL.

The several species of lupine thus far cultivated require a soft, mellow soil. On a hard clay soil its cultivation will not be profitable, as the hardness of the ground will prevent the root from penetrating deep enough. *It will, therefore, be necessary to plough the land at least twice before sowing*, particularly if it has not been under cultivation for many years. The lupine will not grow on very wet soil, where the water will be standing for some months in the year. Carbonic lime is also obnoxious to this plant. Light sandy soil, containing iron, such as we find in the vicinity of Washington, is preferable. Fresh sand is particularly to be recommended.

CULTIVATION.

The lupine requires a mellow soil, and permits only a very slight covering of earth. It desires also warmth and moisture to germinate and grow. To plough the seed under is not advisable, as especially the yellow lupine will not grow when too deep in the ground. Light harrows will suffice. In some instances, when a considerable quantity of rain fell immediately after the sowing, the harrowing has been entirely omitted. The month of April, and perhaps the commencement of May, will be the best time for sowing. *But it should never be done before the grass begins to grow*, as the plant is very sensible of night frosts. If the weather is dry the lupine beans will not shoot very quick. In Prussia ten to sixteen metzen* are usually sown out per morgen. For seed,

* A Prussian scheffel = 1½ bushel; 16 metzen = 1 Prussian scheffel; 1 metze = 0.09748 bushel; 1 Berlin morgen = 0.6309 acre. The average amount of seed would be two bushels per acre. A scheffel costs in Europe about two Prussian thalers = $1 50.

The lupine at the first time grows only slowly in height, as its powerful root has first to form itself. That done, it soon begins to grow above ground very fast, suffocating all weeds.

if not for green manure, eight metzen will suffice. If, however, it is desired to grow as much seed as possible, sixteen to twenty metzen are sown. The plants will then stand so closely together that they will get only a few branches, thus becoming more uniformly ripe.

GREEN MANURE.

There can be no doubt that the lupine, if introduced into this country, will chiefly be cultivated for the purpose of serving as green manure on light and exhausted lands. As such it will, in fact, be a blessing to our farmers. In Northern Germany about twelve to fourteen metzen per morgen (two bushels per acre) are usually sown, if to be used in this manner. The yellow lupine is best adapted to green manuring. It will grow, according to soil, three and even four feet high. The ploughing under ground of the green lupine can be done during or immediately after the time of flowering, which time, if the seed has been sown in May, will most probably in this country arrive at the latter part of July and beginning of August. In Prussia the farmers first employ a large roller to crush down the plant, and then commence ploughing. Others fasten to the plough before the share a strong broom made of twigs, which presses the plant to the ground until it is covered with earth. This latter is the most usual way. Of course, a field where so great a mass of herbs is embodied has not a very smooth appearance. This done, rye or wheat, or any other winter fruit, can be sown either immediately, or, as is more customary, after waiting a fortnight. *The harrowing in of the grain must never be done across the furrows. It must be parallel with the furrows, beginning from the opposite side whence the plough started*, otherwise the lupine roots will be torn out, and the land assume a hilly appearance. Another process is to roll down the lupines, sow upon them the grain, and then plough the whole *but not very* deep. It may be well, according to moisture and warmth, to let the grain thus sown lie two or three days before ploughing. The crop will at first look not as well as that harrowed in, but will afterwards acquire stronger haulms and heavier ears. It must, however, be remembered that the fertilizing power of lupine manure extends not beyond one year.

If the lupine is to serve as manure for field fruits such as oats, potatoes, &c., which are not to be sown in the fall but in the spring, the land may also be ploughed in the fall. But experienced agriculturists advise in this case to let the plant remain during the winter on the field, and then plough it under in the spring. Oats, if sown on such land in the furrow, (*i. e.*, before harrowing,) will especially thrive. The same will be the case with barley.

THE FERTILIZING POWER OF THE LUPINE.

The secret of the fertilizing quality of the lupine is to be found in the following observations:

1. The root of the lupine, which contains a large quantity of moisture similar to the turnip, absorbs more energetically than any other plant the phosphate of iron and natural ammoniac of the soil, thus making the latter more digestible and accessible to other plants.

2. It dissolves the chemical constituents of minerals by the evaporation of its root, which is impossible for other plants; just as the ostrich can dissolve and digest things in his stomach which would be death to any other bird. Thus the surface soil becomes enriched with a humus containing ammonia and a considerable quantity of alkali, phosphate, &c. So great is the effect, that after manuring with the lupine for two or three years *the soil will assume a darker color*. This observation is based upon facts. Even if the plant has been cut and used as fodder, the remaining stubble and root will have a very beneficial

effect as manure, though of course it is preferable to plough under the whole plant.

3 What has been said about the root applies equally to the plant. It has the capability to absorb, in an increased measure, nitrogen and carbon out of the atmosphere, and does not draw upon the humus for its development and growth, as is the case with other manure plants. The lupine communicates its oxygen as ozone, forming thereby in the air which surrounds it ammonia containing nitric acid, something which partly benefits the lupine itself, partly the soil, and also those plants growing in the immediate vicinity and needing manure.

THE SEED OF THE YELLOW LUPINE.

There exists hardly a plant which needs so much as the lupine that the seed should be perfectly ripe, as unripe seed will either not grow at all or the plant will present only a sickly appearance. The gathering of the seed is very difficult. The lower pods will either ripen sooner than the upper ones, burst, and scatter the seed, or some groups of lupines will finish their vegetation sooner than others. But these latter observations have chiefly been made in more northerly climates, and therefore these inconveniences may not exist in our country at all, or at least only in a small degree. The best seed is obtained by cutting and gathering the ripe pods, but that is laborious and troublesome. As, however, the lupine beans have a high fertilizing quality, nothing will be lost by their being scattered on the field. Some farmers have pulverized and used them as surface manure with great success.

The chemical composition of the lupine beans is as follows:

	Yellow lupine.	Blue lupine.
Water	12.2	13.2
Compounds of nitrogen	28.3	22.0
Therein pure nitrogen	4.5	3.5
Oil	5.0	5.6
Soluble matter containing no nitrogen	36.4	43.8
Organic matter, vegetable fibres	14.1	12.2
Minerals	4.0	3.2

General remarks.—As during the first years after its introduction the lupine will chiefly be used for manuring purposes, it will hardly be worth while to say much at present of its value as fodder. It being a very rich and nourishing plant, great care must be taken to prevent sheep and cattle from eating too much of it. After rain sheep should not be permitted to graze on a lupine field. The lupine, in this respect, should be treated just as clover, vetches, &c. These remarks, it is thought, will be sufficient to induce experiments on a scale adequate to what is believed to be the importance of this plant.

CULTIVATION OF ASPARAGUS FOR NEW YORK MARKET.

BY JOHN HAROLD, HEMPSTEAD, NEW YORK.

Few, perhaps, are aware of the labor, expense, and profit of cultivating the article asparagus for the New York market. In order to place the facts on record, I herewith forward a statement made and sworn to by a highly respect-

able member of the Queen's County Agricultural Society, and for which a premium has just been awarded at our annual meeting.

STATEMENT OF ASPARAGUS RAISED BY PETER COCK, OF MATINECOCK, QUEEN'S COUNTY, NEW YORK.

The plot of ground contains 7 acres and $7\frac{53}{100}$ rods by actual survey. The ground was set out at different times, and has been cut, on the average, about seven years, with the exception of two acres, one of which has been cut two years and not yet near up to a successful yield, the other but one year, which was cut but a few days, and consequently very little. The soil is a light, sandy loam, located near the salt water, the surface nearly flat. The crop is manured with New York stable manure, 75 loads (of 14 bushels) to the acre, spread on the surface in the fall and worked in the rows in the spring. The asparagus is set in rows four feet apart and sixteen inches in the row, five inches below the surface, with roots one year from the seed. The crop is cut and put up in bunches four and one-half inches in diameter, seven inches long, weighing three and one-half pounds to the bunch. The crop was sold in New York for twenty cents per bunch.

Yield from April 27 to June 18, 10,112 bunches, sold at 20 cents..		$2,022 40
Expenses of cultivation:		
525 loads of manure, (14 bushels,) at 60 cents per load	$315 00	
Unloading and carting same, four teams and seven men for two days	24 50	
Ploughing and harrowing, team and man 18 days, at $2 50 per day	45 00	
Harrowing, one horse and man, four days, at $1 50 per day	6 00	
Weeding, twelve days	9 00	
Carting to the boat	40 00	
Wear and tear of boxes	10 00	
Cutting and bunching, 253 days, at 75 cents per day..	189 75	
Freight, one-half cent per bunch	50 56	
		689 81
Profit		1,332 59

Forty bunches are considered a fair day's work to cut and bunch. The manure is carted on when the ground is frozen. A severe frost occurred the first week in May, by which about one thousand bunches were lost.

THE AILANTHUS SILK-WORM OF CHINA.

(BOMBYX CYNTHIA.)

BY JOHN G. MORRIS, D. D

It is well known that for ages past the Chinese have employed a coarser species of silk than that furnished by the mulberry worm, for the clothing of the poorer class of people and for other fabrics, and that it is of so durable a character that the same garments manufactured of it are often worn by the second generation.

This worm has been recently introduced into France, where it has excited an extraordinary interest among the higher classes of society, and even secured the favorable attention of the Emperor himself. It is considered by competent judges to be a new source of wealth to the manufacturing industry of the country and of economy to the people. More than three hundred persons, most of whom are members of the Imperial Society of Acclimation, and great numbers of others, are now successfully engaged in rearing the worm. The Emperor himself has granted the use of some parts of his several farms for the cultivation of the *Ailanthus*, on which this insect feeds. The experiment of acclimation has everywhere succeeded, and the produce of silk has been abundant and of a very excellent quality. The cultivators are greatly encouraged to prosecute the work on a still larger scale, and it will not be long before thousands of persons in France and Algeria will be engaged in this profitable and useful business.

It was only towards the middle of the eighteenth century—that is, about 120 years ago—that we find the subject of this silk-worm first mentioned in the writings of missionaries. Father d'Incarville seems to be the first who mentioned it, in a memoir on wild silk-worms, written about the year 1770, in answer to questions which the French government and several learned men had addressed to him.

In 1760 or 1765, d'Aubenton the Younger, in a work entitled *Planches d'Histoire, nat. enluminées, t. x, pl.* 42 *Ins.*, gave a tolerably correct figure of this *Bombyx*, which he called *le Croissant*, from the transparent arcuated lunules in the form of a cross on the wings.

But it was only in 1773 that it was designated by the scientific name of *Bombyx Cynthia*, which should be retained, and which was first given to it by Drury in *Illustrations of Natural History*, vol. II, p. 10, pl. vi, fig. 2.

Cramer, in 1779, and Olivier, in 1790, and other authors, figured and described it under the same name, and no one doubted that it was the famous wild Chinese silk-worm, so well indicated by Father d'Incarville, but no person in Europe knew its caterpillar, nor the plant on which it fed, nor its cocoon.

In 1804 the English botanist Roxburg, in the *Transactions of the Linnæan Society of London*, t. VI, p. 42, pl. iii, designated another species very similar to the preceding, which is domesticated in Hindostan and feeds on the leaves of *Ricinus*, (Palma Christi.) In form and color it nearly resembles *B. Cynthia*, and Roxburg confounded the two. He has given very interesting details of the *Bombyx* of the *Palma Christi*, its caterpillar, cocoon, and silk, considering it as the true *Bombyx* of *China*, and all the entomologists adopted his opinion.

It was only in 1857 that M. Guérin-Meneville, the eminent French naturalist, showed the distinct specific character of the two by a scientific comparison of numerous specimens. The name of Roxburg's insect is now known as *B.* (Attacus) *Arrindia.*

Europe owes the *B.* (Attacus) *Cynthia* to Father Fantoni, a Piedmontese missionary in the province of Han-Tung, who sent some living cocoons to his friends in Turin on the 4th of November, 1856. These cocoons produced the butterfly in May, 1857. Fecundated eggs were laid in June, which were hatched some days afterwards. Father Fantoni had not, however, informed his friends on what the worms fed, but as portions of the leaves which still covered some of the cocoons bore the greatest resemblance to the *Ailanthus*, they gave some to the caterpillars, which greedily devoured them. Here was a great point gained.

M. Guérin-Meneville was at Turin at this time, and obtained several of the cocoons, which he carefully conveyed to France, from which and other cocoons subsequently received he and his collaborators have since procured hundreds of thousands of caterpillars, which have spun their cocoons as in their native country, so that the insect is perfectly acclimated in France, and that distinguished gentleman has the honor of having first introduced it into that country, and thus

has opened a new and fruitful source of wealth and comfort. He has demonstrated that this insect can be reared in France at little expense, and that those who devote a small portion of time to it will gain a rich remuneration.

THE FOOD OF THE CATERPILLAR.

The *Ailanthus glandulosa* is a well known and to many persons a very objectionable tree. It belongs to the family of the Terebinths. The meaning of the Indian name is tree of heaven. It is improperly called the varnish of Japan. It is originally from Japan and China. Linné classed it in the genus *Rhus*, (sumac,) but Desfontaines established a new genus for it, and called it *Ailanthus*. Its leaves resemble those of the sumac; they are winged, oval, sharp, having at their base on each side a tooth terminated by a small gland, and hence its specific name, *glandulosa*. It grows vigorously on all soils and in the shade as well as the most exposed places. Like the sumac, it pushes out suckers from its roots, and can through them be easily propagated. It produces at the extremity of its branches panicles of numerous flowers of a greenish yellow color, of a very offensive odor to many persons. The individuals are either male or female, sometimes hermaphrodite. The fruit is a small, flat silique, containing only a single grain or seed, flat and reniform. These seeds ripen in autumn, and can be gathered from November to January. It is necessary to take them perfectly dry to avoid fermentation. They may be sown from February to May, in rows, borders, or in squares. The seeds need only to be covered with earth to a small extent, and the plants come up in three weeks or a month after sowing. There is no other tree whose growth is so rapid, whose multiplication is so easy, and which flourishes so well on a poor soil.

The trees should be planted in rows; there should be three feet space between each plant, and six feet between the rows. The object of this mode of planting is to produce hedges composed of the clumps of suckers of the *Ailanthus* touching one another, so that the worms can pass from one clump to the other without any help. These hedges, kept at a moderate height and trimmed down when necessary, will render the placing of the young worms on them and the gathering of the cocoons very easy.

Perhaps it will be well to let one tree grow to the height of ten or fifteen feet, which may serve as a point of attachment for various fans or other devices to frighten off the birds; perhaps, also, it would be well to leave one row from the side of the prevailing wind grow to a greater height, and this would become a shelter for the rest of the plantation.

The disagreeable but very fugitive odor which the young leaves of this tree exhale prevents the destruction of the plant by all domestic animals, and thus all enclosures are rendered unnecessary. As to the odor of its flowers, they will never incommode any one, for the low size at which the plants must be kept will never permit them to bloom.

THE EGGS, CATERPILLARS, COCOONS, AND SILK OF B. CYNTHIA.

The eggs are twice as large as those of the ordinary silk-worm, and the females lay only about half the number. The eggs are oval, equal at both ends, white and spotted with black. The number deposited is very variable, and the proportion depends on the size of the insect. When they are in good health and of normal size, they give from two hundred to four hundred eggs, and one large specimen has given four hundred and twenty-nine. The average deposit is about two hundred and fifty.

The caterpillars are hatched out in eight or twelve days, according to the temperature. They are from four to four and a half millimetres long, and appear at first black, because each of the segments bears six black spots and six tubercles of the same color, but examined with a magnifier their skin is seen to be

yellow. These caterpillars, like the great majority of other species, moult or change their skin four times before they spin their cocoons. Before each moult they remain motionless from twenty-four to forty-eight hours, according to the temperature, and this state or crisis has been designated as their sleep. Before going to sleep they line the lower side of the leaf which bears them with a very fine network of silk, and this they solidly grasp with their membranous feet, or tangle them with it so that at the moment of their going out of the old skin it remains attached to the threads of this network, and the caterpillar itself is free.

Their color, size, and general aspect is different after each moult. After the fourth the caterpillar has attained a length of about three inches. It begins to eat less and prepare for its cocoon. After voiding all its excrements and a large drop of liquid more or less transparent, it commences its cocoon, after having attached two or three leaves to a stalk with silken threads, so that it may not fall when the stalk dies at the time of the falling of the leaves.

In weaving its cocoon, the caterpillar does not work like that of the mulberry worm, because it is necessary to prepare an elastic opening for the egress of the butterfly when fully matured. The mulberry worm closes its cocoon all round, and when the perfect insect comes out it cuts the cocoon, so that such cocoons cannot be continuously unwound, because the threads are severed. It is not so with *Cynthia*. It leaves an opening for its exit, or, if not an opening, the cocoon at that end is so thin that the perfect insect can come out by pushing the threads aside without cutting them, and thus the whole may be unwound in a continuous thread.

The cocoons are of an elongated form, and tapering at both ends, of a gray color, more or less pale, and generally from an inch and two-thirds long to two-fifths of an inch thick. They vary much in size and weight, according to the conditions in which they have been spun, and to the degree of desiccation, as is the case with those of the mulberry worm. The product of silk is nearly if not quite as abundant as that of the mulberry cocoon, and as it can be raised with little or no expense, it will be much cheaper.

Samples of this silk from China show that it serves in that country to make stuffs which approach in fineness and lustre those which are fabricated of the mulberry silk, and which rival the most beautiful European stuffs. They make good use of this textile material, both in the condition of coarse silk and in a more refined state.

In France the material has been carded and spun, and a very excellent article has been obtained, and its qualities have been studied and appreciated by manufacturers of the highest respectability. One of them says that he "will engage to fabricate from it a white silk." Another, "that the lustre of the silk surpasses that of all the raw silks of races hitherto known." Another has "found the cocoons very easy to card and spin. The thread is smooth, shining, strong, and supple. It leaves no waste in combing or spinning. It is an excellent material, which has a great future for all industrials in raw silk. The cocoons are easy* to clean, and their silk can, without doubt, bear with success all the operations of dyeing. This culture on a large scale would furnish in abundance a raw silk stronger and more beautiful than that of the mulberry worm." A great silk merchant of Lyons, and author of works on silk, who has instituted some researches on the cocoon of the *Ailanthus* worm, says that "the fine threads of the *Ailanthus* worm are double those of the mulberry worm, but of an inferior diameter; they are also more flat, which lends to them a greater

* The cocoons are freed from their gummy substance by boiling them two hours and a half with 25 per cent. of their weight of white soap, and sufficient water to submerge them entirely. This operation is repeated a second time, with 10 per cent. of their weight of carbonate of soda, for one hour.

degree of lustre." Father d'Incarville reports "that the silk lasts twice as long as the other, and the stuffs made of it wash like linen. If the rearing of these worms were practiced in France, French industry would soon find a rich remuneration."

THE REARING OF THE AILANTHUS SILK-WORM.

The Ailanthus silk-worm can produce three generations, but it is better to have only two broods, coinciding with the two movements of sap in our climate. The eggs of these silk-worms are not kept during eight or nine months, like those of the mulberry, but a part of the cocoons of the first generation and all those of the second close up their living chrysalids and remain inactive during the rest of the autumn and all the winter, in order not to give out their first butterflies until the spring. Abandoned completely to the natural temperature, these cocoons give out their butterflies between the first and thirtieth of June, according to the forwardness of the season. It is possible to hasten or retard this coming out of the butterfly, by keeping the cocoons in places more or less warm. The second brood may be had towards the end of August, as about forty to forty-five days elapse between the deposit of the eggs and the completion of the cocoon.

First rearing.—Presuming that we have preserved the cocoons (slightly threaded together, without piercing them through and through, in chaplets of a hundred or more) during the winter in a place in which the temperature should not often be below 61° Fahrenheit, and where it should never be above 68° Fahrenheit, and that in these conditions the butterflies should come out from the fifth to the tenth of June, the following treatment is to be pursued: Every evening the butterflies which came out in the morning should be put together in a wire safe, or simply in boxes pierced with holes, and which should be covered with bobbinet, taking care that the butterflies have plenty of air.* The next day you take the united couples and place them in other boxes or cases, without separating them. The fecundated females will soon lay their eggs against the sides of the boxes,† which will endure three or four days, according to the temperature. You will do well to remove the males every day which have quitted the females, and put them back into the cage. These eggs, when dry, detached with the finger-nail or with a wooden knife, and kept according to the days of their being laid, should be transferred to a place warmed to 68° or 75° Fahrenheit at least, in which water should be constantly evaporated in order to maintain the degree of proper humidity, and the young caterpillars will be hatched ten or twelve days afterwards.

In order to gather together these young caterpillars, it will suffice to place upon the eggs some leaves of *Ailanthus* growing on the shoots which are tender, taking care to put the inferior face of the folioles beside the caterpillars, which they will immediately mount, range themselves on the under side, and commence to eat the edges.

These leaves, bearing the worms generally attached to the inferior face, should have their stems placed in bottles full of water, the mouths of which should be

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* M. Count de Lamotte-Baracé has remarked that the fecundation succeeds best when the butterflies are put out of doors at night. He says, "The fecundations do not operate well in the baskets. I had every day scarcely half the females of whose fecundation I was certain. This course might do well enough on a small scale, but on a large one it will not succeed. I then thought of placing my butterflies out of doors in a large cage made of canvas, about six feet square. I now regret that I did not employ this method at first, for of one hundred females there were scarcely five or six that did not find males in a day or two. Thus, then, all the females were fecundated, which I was far from obtaining before I had my cage."

† M. de Lamotte has introduced a system of boxes with movable walls, which permit the eggs to be removed with the greatest facility.

shut up with a small stopper of paper, to prevent the young worms from drowning when they change their position.

If unforeseen circumstances—bad weather, for instance—should prevent putting the young worms on the trees, their nourishment can be renewed by placing at the side of these bottles others similarly furnished with fresh leaves, to which the worms will soon pass of themselves. Finally, to save some individuals which might fall—which sometimes happens, because the worms gnaw the leaves at the base, and thus make the extremity fall on which there may be others—it will be well to place at the foot of the bottles some leaves, on which these fallen individuals will soon mount.

It will be necessary to guard against giving to these caterpillars hard leaves gathered from large trees, for they cannot easily eat them, and they would thus perish. This inconvenience would not be felt in plantations made with a view to the rearing of these worms, where the trees would be constantly throwing out shoots and tender leaves.

In his report to the Emperor on this subject, M. Guérin-Meneville proposed to feed the young worms at first in the house, and to continue it to their recovery from their third sleep or moult. Perhaps it will be necessary to proceed thus in certain localities, especially where there are ants large enough to carry away the young worms; but in other places this expense may be avoided by placing them on the hedges of the *Ailanthus* two or three days after their birth. It is thus that MM. de Lamotte and Hebert have proceeded, with full success, since 1859. M. Guérin-Meneville has also done it in Bois de Boulogne, where thousands of visitors have seen them at work for two months, notwithstanding the frequent tempests and cold rains which have prevailed during the whole summer.

To transfer the young worms on the trees in the hedge you must convey to them the leaves covered with worms in baskets secured with paper, and attach small quantities of these leaves on the trees. This can be done with a pin or a thread, for they must be so arranged that the wind may not blow them off before the worms shall have had time to quit the faded leaves to spread themselves on the living branches. As the Chinese recommend, it is necessary to ascertain as near as possible the number of worms which can be nourished on a certain extent of the hedge, so as not to put more worms on it than are necessary. Practice and experience only will teach you how to appreciate this number.

When the worms are placed on the *Ailanthus* there is nothing else to do except to replace some individuals that may have fallen, to draw together some branches which may be too far apart, which the worms may have consumed, to chase away the birds and bats, and to guard them against wasps, &c. * * * When the worms have undergone four moultings, and have finished their growth, they spin their cocoons in the leaves of *Ailanthus* or other trees in the vicinity, and you can gather the cocoons after they are finished, that is, in eight or ten days.

SECOND REARING.

About a month after they are made, the cocoons give out the butterflies, which lay eggs like those of the spring, and the eggs soon hatch. All that has been said in regard to the first rearing applies to this, and if you succeed in obtaining this hatching about the 30th of August, you finish this second rearing in the first days of October, if the season is at all favorable.

The best method of preserving these reproducing cocoons during the winter cannot yet be definitely fixed in the beginning of this new branch of industry, and it is necessary to make many trials before we can establish rules relative to it. In the mean time it is advised that chaplets of one hundred or more be made and suspended in chambers of different temperatures. It is above all necessary not to put too many in the boxes or baskets, for if they should get too warm and ferment more or less, and even if the chrysalids should not die,

they would still contract maladies which would be transmitted to the eggs in the spring, and perhaps to succeeding generations.

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REARING OF BOMBYX CYNTHIA IN CHINA.

According to the evidence of the venerable missionary, d'Incarville, who first made known this silk-worm to Europe, "these worms are a source of riches to China, although they gather a prodigious quantity of mulberry silk every year, of which, as a modern author says, you could make mountains." This rearing is carried on in open air, in plantations of *Ailanthus*, which Father d'Incarville took for a species of fréne (ash tree) or *fagara*, a tree called *tche* by the Chinese, which is also cultivated for this purpose. We find on this subject the following passage in a pamphlet, entitled "*Extract of an ancient Chinese book, which teaches how to rear and feed the silk-worm*," &c.: "There are other wild mulberries which are called *tche* or *ye-sang*. These are small trees which have neither the fruit nor leaves of the mulberry. Their leaves are small, round, and terminating in a point,"* &c. * * * * * *

"There are silk-worms which are no sooner hatched in the house than they are conveyed to the trees, where they are fed and make their cocoons. These rustic worms become broader and longer than the domestic worms, and, although their work does not equal that of the latter, they have their value and ability, as one can judge of the stuff which I have called *kien-tcheou*. It is the silk produced by the worm of which the strings of musical instruments are made, because it is strong and resonant."

From this and other facts stated by this old Chinese writer, and from what Father d'Incarville has said, the *Bombyx Cynthia*, like most of its congeners, is more or less omnivorous, and it could be fed on other plants in the absence of that which is specially assigned to it by nature. We must not, however, conclude from this that all the plants which it would feed on are as favorable for nourishing it as that which is more particularly proper for it, and which should be *Ailanthus* alone. If other food were persisted in for several generations, it is probable that the species would degenerate more or less rapidly, and perhaps be entirely extinguished.

FIRST REARING OF THE AILANTHUS SILK-WORM ON A LARGE SCALE IN FRANCE.

La Patrie, of November 5, 1860, says: "In the last session of the Academy of Science (October 29, 1860) M. Guérin-Meneville presented numerous and beautiful living cocoons of the Ailanthus silk-worm, the product of the first rearing, on a large scale, of this new domestic insect, for the introduction and acclimation of which into France and Algeria we are indebted to him. This is a real agricultural event, for, as the learned president of the Society of Acclimation has stated, these victories of man over nature are so rare that, of the one hundred and forty thousand species composing the animal kingdom, he has for ages past acquired dominion only over about forty, as far as agricultural or industrial utility, in general, is concerned. In making this presentation, which was received with marks of the liveliest interest by the academy and the public admitted to the sessions, M. Guérin-Meneville thus expresses himself:

"'In devoting itself to the most abstruse and elevated theoretical studies the academy has not neglected the practical applications of science. Its organization even demonstrates that fact, for it counts among its members many learned men, whose works are specially devoted to the applied sciences, and, among them, the section of rural economy. It has also received with great interest the

* This is evidently the *Fagara piperata*, of which the Chinese author here speaks.

communications which I have had the honor to make for a long time on applied zoology, and recently on the introduction of the silk-worm of the *Ailanthus*, destined to play an important part as the producer of a new textile material, which will add greatly to our industrial resources in silk and wool, the scarcity of which is making itself grievously felt.

"'The practical experiments in rearing this silk-worm are increasing every year in number and importance, and my persevering energy, encouraged by the unanimous assent of all the friends of our agriculture and industry, seems destined to be crowned with success. In fact, notwithstanding the inclement weather which has prevailed this year, my practical experiments have given the most satisfactory results, so that many proprietors of estates are engaged in making plantations of *Ailanthus*.

"'I will not now revert to my experiments in the open air made in the woods of Boulogne, for thousands of visitors and many members of the academy, among whom I will name Marshal Vaillant and Geoffroy Saint-Hilaire, have examined them, and have, in writing and in word, testified to me their highest satisfaction. I come to-day to submit to the inspection of the academy a sample (three thousand living cocoons) of the product of the first rearing in France on *Ailanthus*, planted specially in view of this brood by Count de Lamotte-Baracé, on his beautiful domain of Coudray-Montpensier, near Chinon.

"'After having simply placed the young worms on the hedges of the *Ailanthus* of his planting, M. de Lamotte, treating this rearing exactly as he would cultivate the cereals, vines, rape, &c., without employing any manual labor, or extraordinary precautions against the attacks of birds or other enemies, and notwithstanding almost constant bad weather, has still obtained more than one hundred thousand beautiful cocoons, which are destined for reproduction for the next year, and from which I shall derive a sufficient quantity of eggs to satisfy the numerous demands which I receive every day. In fact, each female butterfly furnishing more than two hundred and fifty eggs, supposing that the half of our one hundred thousand cocoons to contain females, these fifty thousand butterflies would give me more than twelve millions of eggs, a quantity greater than will be necessary, for the plantations of *Ailanthus* recently made would not nourish all these worms.

"'We can at present say, without exaggeration, that the only manual labor necessary for this operation in the open air is the care of the eggs, the hatching of the young worms, placing them on the plants, and gathering the cocoons. When the worms are once properly brought to the trees, the operator has only to let them feed about a month, and he will find his harvest suspended to the branchlets, on which he will often have more than twenty cocoons, as the academy can see in looking at the leaves which I have placed on the table.

"'It is this simplicity in the process of rearing, this nearly complete absence of manual labor, which distinguishes my new culture from that of the mulberry worm. In fact, we know that the latter requires buildings, heating, and numerous workmen to gather the mulberry leaves, to carry them to the nursery houses, to feed the worms four or five times a day, to change the broods frequently from place to place, and properly to place or arrange the branches on which they spin their cocoons.

"'I thank the academy for the extreme kindness with which it has received my communications on this subject. I inform those of our members who feel interested in it that they will find numerous details on this new agricultural branch of industry in my "*Rapport à S. M. l'Empereur sur les travaux entrepris par ses ordres pour introduire le ver-à-soie de l'ailanthe en France et en Algerie*," and also in a small treatise entitled, "*Education des vers-à-soie de l'ailanthe et du Ricer, culture des vegetaux qui les nourissent;*" a work destined to serve as a guide to persons who wish to devote themselves to this culture.'

"We add," says *La Patrie*, "that M. Guèrin-Meneville, having only the

public interest in view, has determined generously to afford the advantages of this new source of wealth to the Imperial Society of Acclimation, and to all other persons who shall request it."

CONCLUSION.—RESULTS.

At a time when silk, in consequence of the malady of the mulberry tree and of its silk-worm in Europe, is becoming more and more scarce and dear; when the production of cotton will most probably decline; when the prices of provisions are rapidly advancing, the discovery of a textile material, which can be produced on our soil in great quantities and at a low price, should be considered a fortunate event.

It is demonstrated that the silk furnished by the *Bombyx Cynthia*, which lives in the open air on the Ailanthus, combines all these conditions.

The *Ailanthus* is of easy culture; it grows everywhere, even in the sand and the most sterile soil, where nothing else that is profitable can be raised. When once planted anywhere it cannot be destroyed, so rapid and vigorous is its growth.

The silk-worm which feeds on its leaves is not less vigorous and enduring. Neither wind nor rain nor anything else can make it quit the leaf it is devouring, nor the cocoon it is spinning.

The open air is necessary to it: we want no costly nursery-houses for it; it lives on the tree itself, not on gathered leaves, and requires no manual labor and very little care. The silk which it produces is less brilliant than that of the mulberry worm, but it is strong, more durable, and easily takes colors. It is a kind of raw silk, and holds a middle place between wool and silk. Produced *in the open air and nearly without expense*, this material, which we call *ailantine*, will be of a very low price; it will serve for the fabrication of various articles of clothing.

The *ailantine* will be the silk of the middle classes; it will not interfere with the silk of the mulberry, which will continue to be the silk of luxury.

The principal advantages resulting from the cultivation of the Ailanthus and its silk-worm can be thus summed up:

Ground uncultivated and of little value can be brought into use and rendered productive; a very remunerative product can be obtained with little expense and labor; it will supply the deficiency of silk; it will produce on our own soil what we now get from abroad in exchange for our gold; it will secure for all classes of society solid, comfortable, and low-priced articles of apparel.

THE HORSES OF NEW ENGLAND.

BY C. L. FLINT, SECRETARY OF MASSACHUSETTS BOARD OF AGRICULTURE.

The New Englander wants a horse of all work; one that can go on the road and not leave him behind his neighbor; that can draw his produce to market, and as much of it as it is reasonable for any horse to draw; that can carry his family to meeting, his grist to mill; one, in short, that can turn his feet and his muscles to anything and everything that comes within the range of muscular power to perform.

If it is possible to unite these qualifications in any one animal, he will get him if he can. If this cannot be done, he will take the next best thing—something adapted to his special purpose, whether it be in the form of a roadster or

a carriage horse; a farm or a draught horse; a horse to grind clay or to saw wood on an endless chain power; but whatever his specialty may be, his horse must turn his attention to a great variety of employments whether he does them well or ill.

Very few horses are kept in New England for mere sporting or pleasure. They must do something, and do it earnestly, and not eat their heads off in pampered idleness. Now and then, to be sure, there are exceptions, but they are rare, very rare, compared with the aggregate number.

The horses, like the neat cattle of New England, combine an infinite variety of blood, deriving their origin from many sources, and yet they are distinct, in many respects, from those of other sections of the country. Their peculiarities are due, in part, no doubt, to the climate and physical features of the country, the condition of the roads over which they travel, and the farms on which they are bred, and to the habits of the people. But that they possess peculiarities which distinguish them from the horses of other sections no one familiar with the stock of the country would be disposed to deny. Even in the city of New York, where animals are collected from every quarter, the practiced eye can usually detect those of a New England origin from those originating in other sections, though it might be difficult to tell in every case upon what particular points the judgment was based.

The horses of New England do not constitute a distinct breed. They are the result of a mixture of the English, the French, the Spanish, the Flemish, the Danish, and other horses, which were imported at different times by the early settlers as most suited their convenience, with the modifications produced by crosses of more recent importations.

The only race that can claim exemption from this general rule is the thoroughbred, which traces its origin back to the hot blood of the desert, the Arabian, the Barb, and the Turk, and of this there are but few representatives.

In some sections the identity of some of the races which formed the original stock is distinctly traced in the form and characteristics of many of our horses,

but in others it is entirely obliterated, no regular pedigrees having been kept, no regular system of breeding having been adopted, the general practice having been, from time immemorial, particularly in the earlier history of the colony, to secure the services of the nearest and cheapest stallion and to breed from him. Still, notwithstanding the want of a common and reputed origin of these horses, they possess on the whole such excellence in some respects as to justify the encomium of a recent author on the *Horses and Horsemanship of America*, when he says that "for docility, temper, soundness of constitution, endurance of fatigue, hardiness, sure-footedness, and speed, the American roadster is not excelled, if equalled, by any horse in the known world not purely thorough-bred. It may well be doubted whether, in many of these essential qualities, the New England roadster is equalled by the thorough-breds of the present day." In the three first qualities—docility, temper, and soundness of constitution—he is certainly not surpassed, while for practical service on the road his reputation is established abroad as well as at home.

Since the commencement of the present century, the horses of New England have undergone a very material change. Perhaps this change should date back as far as the beginning of the French revolution, at which period the prices of horses began to advance rapidly in consequence of a greatly increased demand, and the attention of many farmers was turned in this direction. But some change might naturally be expected from the complete modification of the habits of the people on the improvement of roads and the introduction of the modern light vehicles, which led gradually to a change in the labors of the horse without any well-directed effort at breeding.

Down to the beginning of the present century, and for some years after, the principal means of carrying on the inland business of the country, including a large amount of heavy transportation, the horse was relied upon almost exclusively, while he was subjected, like his master, to all the hardships and exposures incident to a new, rough, and unbroken territory. The roads, as may well be imagined, were in the most wretched condition, compared with the admirable roads of the present day in all parts of New England. Till a somewhat recent period they were made of the natural soil only, sometimes thrown up a little in the centre to shed the water, but often not even this. In many a thousand miles of back roads the forest was merely cut down, and the ground left without so much as side ditches.

It often happened at certain seasons of the year that these roads, always hard, were next to impassable, but over them the freight of the country must be moved, and often, too, in heavy lumbering wagons designed for the hardest kind of service. The modern light buggy would have been comparatively useless, and a speed, now seen every day, wholly unsafe and impracticable.

The farmer had his teaming to do, and so, too, the country tradesman, and their markets were in many cases at long distances. To do this teaming a powerful, willing, medium-sized draught horse was required—one capable of travelling on the road and adapted at the same time to general work on the farm. Speed was not requisite in horses kept at this class of work, and horses were rarely put to it except in some of the lines of stage-coaches, and the mail contracts even were made at a speed often less than five, in many cases less than four, miles an hour.

But there was one peculiarity in the habits of the times, the traces of which were left within the memory of men still living. Owing to the condition of the roads—often to the entire want of roads—all classes of people made a far greater use of the saddle than has since been the case. The habit of horseback riding was very general for ordinary travelling; not so much as a matter of pleasure as of necessity. This led to the use of a horse peculiarly adapted to the purpose. By far the larger part of the horses kept in the more remote towns a century ago were pacers. I have been told by one eminently familiar

with the horses of New England from sixty to seventy-five years ago, that at least four-fifths of them had the pacing gait, which was thought to be not only faster but safer than the trot over the bad roads and the hard paths of that time. Everybody rode on horseback, if he rode at all, on distant journeys and in travelling from town to town. The saddle was in constant demand, and the horse was trained by constant use to the easiest gait.

Hence arose a class of horses widely known in the more thickly-settled portions of New England, especially in Rhode Island, as the Narragansett pacers. They became very popular in the earlier part of the last century, and continued to be the favorite horses for light travel under the saddle for many years. From all the accounts we can gather from the documents of those times, and from the lips of men who remember them well, they must have been the easiest, fleetest, most sure-footed, and toughest saddle horses ever known in this country, if not in the world; and it is to be regretted on some accounts that they were allowed to become entirely run out. They could not trot. The pace was their natural gait—the only one in which they excelled—and for this they were especially esteemed.

The origin of that famous breed, which was kept distinct for many years, was probably a stallion imported from Andalusia, in Spain, though there are several theories, founded on tradition, in regard to him. But from whatever source derived there is no doubt that he laid the foundation of a class of horses exceedingly well adapted to the wants of the times—one that served the purposes for which it was raised more completely than any other at that time or ever since known in New England. Many of the Narragansett pacers could go a mile easily in less than three minutes, or carry a rider forty or fifty miles a day, and follow it up for days in succession, without apparent fatigue. It is said that their gait was far easier and more agreeable than that of the racker or pacer of the present day, with whom the pace is an accident, or the result of training, rather than the natural gait.

The Narragansett pacers became so popular that they were exported in great numbers to the West Indies, and the business of breeding them for that market became very profitable. At length, however, the demand there became so great that an agent was sent to buy up all the best he could find in the locality where they were bred in the highest purity and perfection, and he was so faithful to his trust as to allow few very superior animals to escape him. This circumstance, together with the improvement of the roads, and the fact that the genuine Narragansett pacer was comparatively useless as a draught horse and really good only under the saddle, led to a decline in the interest in breeding this class of horses, especially during and after the war of the revolution, when large numbers of horses were wanted for teaming and transportation. The pacer, as a breed, was wholly neglected, till, in the year 1800, it was said there was only one animal of the real Narragansett stock to be found in Rhode Island.

During the last century a good many English or thorough-bred horses were kept in various parts of New England as stock-getters. Especially was this the case towards the close of the last and in the early part of the present century, and in the more southerly portions of this section, as in Connecticut and Massachusetts. Such stallions as Bajazet, Bucephalus, and Obscurity are said to have been brought from Virginia into Connecticut between the years 1790 and 1794, and to have been kept at Hartford and vicinity for the use of the country mares, at moderate charges. Their stock was at one time thought very highly of in Connecticut, and it became quite common in that part of New England. Then there was Highlander, kept at Litchfield, and later, I believe, King William, a thorough-bred by King Herod, Don Madcap, by Snap, and

Matchem, Guido, Benjamin, and probably others, were kept at Hartford about the year 1798.

Some of these horses, especially King William, left a great deal of valuable stock in that neighborhood, and in the southern and western part of Massachusetts. This horse, King William, and probably one or two of the others, were taken into Vermont and New Hampshire, and are said to have left their mark on the stock there; but as little attention was paid to records, it is not probable that anything definite and trustworthy can be ascertained in regard to them.

It may not be out of place to remark that at that time, sixty and seventy years ago, some popular horses were kept as stock-getters in Boston, and among them were some that were commonly called English horses, as they probably were. There are those still living who well remember the names and characters of some of the horses kept for stock there, and I obtained my information from them.

About the time of the earlier importations into Hartford, above mentioned, another horse, called "Beautiful Boy," or "True Briton," was kept there. He was probably thorough-bred, and was said to be a horse stolen from General DeLancey, at King's Bridge. Selah Norton, his owner, advertised him in the "*Connecticut Courant*," on the 26th of April, 1791, in which he describes him as a "bright bay, fifteen hands high, trots and canters very light." This horse was kept some time at Springfield, Massachusetts, and became the sire of the old Justin Morgan, foaled in West Springfield in 1793, a horse that has had a posthumous fame surpassed by that of no other animal that ever stood in New England. He was the founder of the Morgans.

Little is known of the dam of the old Justin Morgan, though from the fact that so large a number of pure thorough-breds and grades had been kept in that section, it has been conjectured that she had more or less thorough-bred or English blood through "Wild Air;" while some have supposed that she was a descendant of Lindsay's Arabian, imported into Connecticut in 1766. In the absence of any authentic information in regard to her, we may suppose that she had more or less of French or Canadian blood, and that through her the Morgans get some of their characteristics, such as the heavy mane and tail, the hairy legs, &c., marks which have certainly given some color to the assertion that the old Morgan was a Canadian horse, or closely allied to that race.

However this may be, it is certain that the Justin Morgan was taken from Springfield, Massachusetts, to Randolph, Vermont, in 1795, when a two year old colt. He has left so distinct a mark on the horses of New England that it may not be out of place to give a somewhat detailed description of him. He was a small horse, only about fourteen hands high, and his weight, by estimation, about nine hundred and fifty pounds. He was a beautiful dark bay, with scarcely a white hair on his body. His legs were black, his mane and tail were black, coarse, and thick, with long, straight hair, free from curls. He is described as having a good head of medium size, lean and long, with a straight face, broad and good forehead, and fine small ears, set wide apart. He had a very short back and wide and muscular loins, but rather a long body, round and close ribbed up. He was compact, or what many would call extremely snug built, with a deep wide chest and projecting breast-bone, short, close-jointed legs, wide and thin but remarkably muscular, but with some long hair about and above the fetlocks, a peculiarity which he imparted to a good many of his offspring.

The old Justin Morgan was said to have been a very fast walker, but in trotting he had a short nervous step, a low smooth gait, square and fine. He was not remarkably fast as a trotter, though his speed was never developed as it has been with the greatest assiduity in many of his descendants. In travelling he raised his feet but slightly, only enough to clear the inequalities of the ground, but notwithstanding this he had the reputation of being very sure-footed. His style of movement was lofty, bold, and energetic, full of life and spirit, but

he was managed with great ease, and it was said that a lady could drive him with perfect safety. He was much admired as a parade horse.

Though not what would now be called a very fast trotter, the old Justin Morgan could run at short distances with any other horse of his time not thorough-bred, and many an eighty rods accomplished by him won his keeper the stakes, payable at the tavern where the scratch was made in the dirt across the road as the point to start from. Each horse had to "come up to the scratch," and when the hat fell to be off as fast as his legs could carry him, but in all such trials the "little horse" was always sure to come out a little ahead.

Like most of the stock horses of his time, especially in the more remote sections, he had to work hard in clearing up new land, and in this laborious kind of work he exhibited the most wonderful strength and willingness at a pull, and the most remarkable patience at a dead lift, a characteristic, one would suppose, strongly in contrast with his nervous playfulness at the end of a halter or under the saddle. He would "outdraw, outwalk, outtrot, and outrun" any and every horse that was ever matched against him, and that, too, notwithstanding the fact that many of them were much larger and heavier animals. Strength, speed, as compared with the horses of his time, and endurance were characteristics in which he especially excelled. He survived the hardships to which he was almost constantly subjected for twenty-nine years, and then received a kick from horses in the same yard, which resulted in his death in the year 1821.

There can be no doubt that the old Justin Morgan impressed his own sterling qualities upon his offspring to an unusual degree; most of his immediate descendants exhibited them very strikingly, and they appear to this day to be very distinctly traced wherever a strain of his blood flows.

Owing, probably, in some measure to the character of the climate, and in part, no doubt, to the severe labor to which horses were subjected, it so happened that when the attention of breeders was turned more especially to the improvement of our horses, some thirty or forty years ago, they found an admirable foundation for it existing in the common stock of the country, which furnished abundant materials, and in sufficient variety, to encourage the highest efforts of skill. Whoever remembers the character and qualities of the horses of that period, as exhibited in the admirably conducted stage routes running eastward from Boston, will readily understand and appreciate this fact. For steady, honest work on the road, good for eight and ten miles an hour in some cases, and generally for from six to eight, they were excelled by no horses in the country, if, indeed, in the world. Training, feeding, and usage, it may well be supposed, contributed very much to it, but to whatever source it was due the class of horses represented in the stage-coaches of that day, so completely adapted, as a general thing, to the road and the work of the roadster, constituted a basis or foundation as good as could be desired for the exhibition of the skill and judgment of the breeder; and it is not surprising that, with such excellent materials at their command, so great an interest should have been created on the part of individuals, which gradually extended among the farming community as the profits to be derived from judicious breeding became more and more apparent.

Then, fortunately, the most splendid stock horses were accessible in such animals as the direct offspring of the old Justin Morgan, and the Sherman, Woodbury, and Bulrush Morgans, the three most renowned sons of the "little horse," were standing at various places in Vermont, Massachusetts, and New Hampshire. Then, too, such horses as "Cock of the Rock," sired by Duroc, and he by imported Diomed, and Sir Charles, also sired by Duroc, were standing in New England, to say nothing of Rowan, a thorough-bred, imported, and kept at Northboro', Massachusetts, or the two thorough-breds sent over by Admiral Sir Isaac Coffin, or of Bellfounder, a Norfolk trotter, kept for some years in the vicinity of Boston, to say nothing, too, of many of the immediate offspring of Messenger, the most excellent stock-getter, probably, of all the thorough-breds

that ever left their mark upon the common stock of the country. Take away the improvements which Hambletonian, a son of imported Messenger, left on the stock of Vermont, and, indeed, on that of all parts of New England, and it would be difficult to see how the loss could be made good. His stock, and also that of the many other descendants of old Messenger, are to this day held in the highest esteem, and most deservedly so, for their speed, their great power of endurance, and for their large size and excellent style as carriage and draught horses, or horses for general utility. Satisfactory evidence that a horse is a Messenger—that is, a direct descendant of the old Messenger—is generally regarded as a sufficient certificate of his goodness.

It should be borne in mind, also, that the French Canadian horses, in many respects most excellent as horses for all work, tough, hardy, docile, easily kept, tracing their origin back through the splendid Norman French stock, and deriving many of their great merits from it, had been brought into New England in great numbers. They had iron constitutions, and an almost absolute freedom from disease, and were most admirably adapted to our climate and our long, hilly roads. It was such a mare as this, bought in 1812 out of a six-horse team that was employed in carrying merchandise between Montpelier, Vermont, and Boston, weighing a thousand pounds, and described as a dark bay, with black legs, heavy mane and tail, low and compact, with rather heavy limbs, large joints, a good head, a large, powerful neck, a sharp but rather a lazy trotter, but a hardy, rugged, and enduring animal, was put to the old Justin Morgan horse, and became the dam of Bulrush, transmitting to him the dark bay color, the black legs, mane, and tail of both sire and dam. Nor is this the only case. An examination of the pedigrees of Morgan and other horses in New England, so far as they are known, will show a large infusion of this blood, and, what is more to the point, will show that a great many of the most celebrated of our horses owe something, at least, to Norman blood, as introduced through the Canadian stock.

Bulrush Morgan, one of the three celebrated sons of the old horse, was foaled about the year 1813. He was, in many respects, a very superior animal. He is described as having possessed a more remarkable muscular development than either the Woodbury or Sherman Morgan, with a longer back than either of them, but without the swag back so often objected to in them. His chest was deeper, his shoulders thicker and not so well placed, and his head and neck not quite so well set up, nor was his carriage so lofty, bold, and proud as that of the Woodbury Morgan, while his step was longer and less nervous than that of the Sherman, but he was a sharp, quick driver, and a faster trotter than either of them. All accounts agree that his power of endurance was unsurpassed and perfectly wonderful. His stock, which he marked very strongly, is exceedingly numerous and widely distributed. He was kept in Vermont till the year 1830, when he was kept a year or two in Maine, after which he returned again to Vermont. In 1834 and 1835 he stood in New Hampshire, when he returned again to Vermont, but to go into New Hampshire again in 1842, where he remained till he died, in 1848. The Bulrush Morgan was fourteen hands high, and weighed about a thousand pounds.

Of the Bulrush horses the Morrills have gained a deserved popularity. The dam of young Morrill was a Sherman Morgan, while the dam of the old Morrill was a Messenger, a great-granddaughter of imported Messenger. Young Morrill took the first premium at the Vermont State fair in 1855, the first among the Bulrush Morgans at Rutland, Vermont, in 1855, and the first in the class of horses for general utility at the national fair in Boston in 1855. Morgan Emperor, another son of Bulrush, was the sire of North Star and of the famous Chicago Jack, as well as of many others not unknown to fame.

Sherman Morgan was older by some years than Bulrush, having been foaled in 1808 or 1809. Nothing very definite is known in regard to his dam, but the

probability is that she was at least part thorough-bred. Sherman was a bright chestnut, less than fourteen hands high, and weighed only nine hundred and twenty-five pounds. He is described as having a lean and well-shaped head, small and fine ears, eyes full, prominent, and lively but small, legs broad, flat, and sinewy, chest full, with a prominent breastbone, shoulders large and well placed, neck very good, hips long and deep, back broad but inclined to swag. From the age of four years he was kept at very hard work during nine or ten months of the year, his owner being engaged in teaming all through the winter months between Vermont and Portland, Maine. Sherman was kept in 1830 at Dover, New Hampshire, in 1831 at Ten Hills Farm, near Boston, Massachusetts, in 1832 at Dover again, and in 1833 at Lancaster, New Hampshire. He died at Lancaster in 1835. He was a horse of less style, less nervous and high-tempered than the Woodbury, but a free, quick traveller, and of great powers of endurance, always willing, steady, and powerful at a dead lift.

The Woodbury Morgan, another son of the old Justin, was foaled in May, 1816. Little is known of his dam except that she was large in size, being over fifteen hands high and weighing about eleven hundred pounds. She is described as a deep bay, with black legs, mane, and tail, not very compactly built, rather flat-ribbed, but of good chest, fine shoulders and hips, head and ears fine, of a stylish gait, and a free, spirited driver. Woodbury was one inch less than fifteen hands high, and weighed about ten hundred pounds. He was a beautiful dark chestnut, with a white stripe in the face, snugly and compactly built, had heavy quarters and deep flanks, with a short, broad back and loins. His style of action was bold and resolute, so much so as to make him a very favorite parade horse. Among his descendants are Morgan Eagle, the sire of Lady Sutton and of a numerous progeny of compact, hardy, and fine-driving horses. The Gifford horse was one of his sons, and left a good deal of very excellent stock, among which was the Hale horse, or Green Mountain 2d, and others, all possessing fine style of action and great endurance

These three, Bulrush, Sherman, and Woodbury, were the only stallions left by the old Justin Morgan that got much stock or that gained a wide reputation. The qualities and blood of the old horse have been transmitted through them to a very numerous line of descendants, scattered over not only all parts of New England, but widely over all parts of the country. Nor have these different lines been kept very distinct; they have been crossed and recrossed into each other in every conceivable direction, and mixed in many ways with other strains of blood.

From the foregoing statement in regard to the leading characteristics of the Morgan horses, as shown in some of the most prominent founders of that class of animals, it must be evident that they possess many of the essential qualities of a horse adapted to the wants of a population like that of New England. In his hardihood and strength of constitution, eminently adapted to the climate, in his medium size, powerful action, good feeding qualities, docility of disposition, and early maturity, he combines, certainly, many of the requisites absolutely essential in the composition of a good New England horse. In regard to his size, and the influence he has had and is still exerting upon our horses, more will be said upon a subsequent page.

Another class of horses which has become very popular in New England as light, stylish roadsters, is that known as the Black Hawk. No horse is more prized, as a trotter in light vehicles, than a genuine Black Hawk, with his lofty, restless action, his speed, and his beauty.

The old Black Hawk was foaled in Greenland, near Portsmouth, N. H., in the year 1833. At the age of four years he was sold as a roadster for the sum of $150. In 1842 he won a match of a thousand dollars, trotting five miles over the Cambridge track in sixteen minutes. In the year 1844 Mr. Hill bought and kept him as a stallion, at Bridport, Vermont, till the time of his death, in

1856. His skeleton is preserved in the office of the secretary of the State Board of Agriculture, at the State House, in Boston.

Black Hawk was a trifle less than fifteen hands high, and weighed, when in condition, not far from ten hundred pounds. He was a remarkably symmetrical and muscular animal, graced with the most beautiful head, neck, and limbs, and when in action, whether in harness or out, of a spirited, nervous, and elegant bearing, which could not fail to command universal admiration wherever he appeared. He could easily trot his mile in two minutes and forty seconds, even without much training; and he combined with great speed the perfection of form, the intelligence, courage, and endurance sufficient to make him a complete model of a roadster and the type class. He possessed the power of transmitting his characteristics to his very numerous offspring in a degree surpassed by no other horse in the country. In the carriage or under the saddle, in the quiet of a country road or on the parade ground—under whatever circumstances the descendants of old Black Hawk appear—the eye accustomed to observe the characteristics of the horse could hardly fail to detect the relationship. The Black Hawks command a high price, and are much sought after as light carriage and saddle horses.

As an evidence of their qualities, as well as the celebrity they have obtained in other parts of the country, it may be stated that at the fair at St. Louis, in 1859, five out of six of the best stallions exhibited in the class of roadsters were Black Hawks; and the prize of one thousand dollars that year, and of fifteen hundred dollars at the fair there in 1860, were awarded for the best stallions in this class to sons of the old Black Hawk. At the various fairs in New England—those held at Springfield, at Boston, and elsewhere—the Black Hawks have been very largely represented, and have generally carried off a full proportion of the prizes offered. More than one hundred horses of this stock were entered at the Springfield, Mass., horse show in 1860, and nearly half of all successful competitors were Black Hawks. Many sons of the old horse are now standing in various parts of New England as stock-getters, and, judging from the reports of State fairs in other parts of the country, it is safe to affirm that they are exerting a widely extended influence on the stock of the United States.

With regard to the origin of the old Black Hawk, some people believe it to be conclusively shown and proved beyond the shadow of a doubt that he was sired by the Sherman Morgan, and that his dam was a half thorough-bred mare, raised in New Brunswick—a very fast trotter, and in every respect a very superior animal. I do not know that there is any dispute about the dam; but if any one presumes to cast a doubt on the sire he is liable to be called an enemy of the old horse, or, at least, uninformed upon the question. It is, therefore, by no means a pleasant task to attempt to state anything which may appear to conflict with what those who profess to know most about the pedigree of the horse believe to be true. But the old Black Hawk is gone, and the blood of the old Justin Morgan has become so extremely diluted during the forty years since his death that it is difficult to see how a fair statement of the question or the expression of a doubt as to the original connexion of the Black Hawks with the Morgans can materially affect the interests of individuals or the character and reputation of the horses, especially as the very highest merits and the noblest qualities are conceded to both, and as they are now so generally mixed by cross-breeding that comparatively few animals kept strictly for stock purposes remain distinct which can, in the nature of things, possess a very large share of the blood of the original Morgan. But horses have always been a favorite source of controversy, and probably no extent of fairness and candor in statement would ever satisfy either party interested in any such controversy.

The old Sherman Morgan, as we have seen, was foaled about the year 1808, although, strange as it may seem, there is some question about the date, and, of

course, about his age, when, as we have also seen, he stood at Dover and vicinity in the year 1832. During the latter part of his life there was often with him, as a teaser, another fine stallion, commonly known as Paddy. There can be little doubt that Paddy stood by his side in 1832, notwithstanding the attempt to prove an *alibi*. There are those still living who remember him well. He is said to have been a beautiful animal, possessing a high strain of English blood, though often mentioned as a Canadian or French horse.

The facts, as related to me by the late Hon. Moses Newell, of West Newbury, Mass., who personally knew the "boys" who had charge of the stallions, and who obtained them directly from the lips of one or more of them, were, that the mare had been stinted to the Sherman repeatedly, and was still in heat, when, one Sunday night, after dark, with lanterns in hand, they put her to the teaser. Now, as she went to both horses, according to the testimony of the boys in charge, I suppose it would be difficult to say positively which was the sire. One would suppose that the chances were that it was the last to which she was put, though it would be hard to swear to it. It will be borne in mind that the Sherman must have been at that time not far from twenty-four years old. Those who knew the teaser declared that Black Hawk was a perfect image of him, while very few would maintain that there was any striking resemblance to the Sherman, who was accustomed to mark his colts very strongly, as most of the Morgans did. Black Hawk was a remarkably clean-limbed horse, and had none of the long tufts of hair on the legs as the Sherman had. Mr. Hill, who, while the horse was alive, and the reputation of the Morgans was at its height, was naturally interested in showing the relation of his horse to that celebrated class, procured affidavits and whatever other evidences could be obtained of that relationship, had the candor to admit to Colonel Newell, as I was informed by the latter, that there was a reasonable doubt upon the point; showing that during his investigations he may have met, as he probably did, with conflicting opinions and conflicting testimony in regard to it.

It is a curious fact that of all the stallions got by Black Hawk of which the pedigrees are given in Linsley's "Morgan Horses," only three fell below a thousand pounds in weight, and scarcely one fell below fifteen hands in height. Stockbridge Chief, foaled in 1843, was sixteen hands high, and weighed 1,200 pounds; Selim, foaled in 1844, weighed 1,100 pounds, and was fifteen and a half hands high; Sherman Black Hawk, foaled in 1845, was fifteen and a half hands high, and weighed 1,080 pounds; Vermont Chief, foaled in 1848, was fifteen and a quarter hands high, and weighed 1,075 pounds; Turner's Black Hawk, foaled in 1848, was fifteen and a half hands high, and weighed 1,100 pounds; President, foaled in 1848, was sixteen hands high, and weighed 1,050 pounds; Champion Black Hawk, foaled in 1849, weighed 1,100 pounds, and was fifteen and a half hands high; Black Hawk, jr., foaled in 1849, was fifteen hands high, and weighed 1,050 pounds; Black Hawk Chief, foaled in 1849, weighed 1,034 pounds, and was fifteen and a half hands high; Rising Sun, foaled in 1850, was fifteen and three-quarter hands high, and weighed 1,100 pounds; Rip Van Winkle weighed 1,100 pounds; Plato, foaled in 1851, weighed 1,100 pounds, and was sixteen hands high; Addison, foaled in 1851, weighed 1,175 pounds, and was sixteen hands high; Black Hawk Napoleon, foaled in 1852, was sixteen hands high, and weighed 1,100 pounds; Black Hawk Prince, foaled in 1851, weighed 1,150 pounds, and was sixteen hands high; the Baxter horse, foaled in 1852, was fifteen and a half hands high, and weighed 1,050 pounds; Wild Air, foaled in 1850, was fifteen and three-quarter hands high, and weighed 1,095 pounds. The Esty horse, Andrew Jackson, Ethan Allen, and many others, might be mentioned. It will be seen that the average height of the above-named horses is over fifteen and a half hands, and the average weight 1,095 pounds.

Of Sherman Morgan's get, the pedigrees of which are given by the same

authority, only two exceeded a thousand pounds in weight, and only one was up to fifteen hands in height. Fox, foaled in 1813, was fourteen hands high, and weighed but 975 pounds; Royal Morgan, foaled in 1821, weighed 1,000 pounds, and was but thirteen and three-quarter hands high; Morgan Rat, foaled in 1822, was thirteen and a half hands high, and weighed but 850 pounds; Morgan Tiger, 2d, foaled in 1827, was fourteen and three-quarter hands high, and weighed 975 pounds; Billy Root, foaled in 1829, weighed 942 pounds. Nearly every one of them is described as having had more or less long hair about the legs and a star in the face.

I have no interest whatever in maintaining either side of the question as to the origin of the Black Hawk, nor do I think it a matter of sufficient consequence to quarrel about, and I give the facts as I received them from very high authority, simply because the point could not be wholly ignored in any statement respecting the classes of horses to which it relates, both of which have exercised a more direct and powerful influence on the stock of New England during the last twenty years than any, and, perhaps, than all other breeds or classes of horses put together. But great men lived before Priam, and good horses were found in large numbers in the eastern States long before Black Hawk, and before the sons of old Justin Morgan had impressed their stamps upon them.

Among the celebrated horses which have left their mark most distinctly upon the stock of New England none, certainly, can be more worthy of mention than imported Messenger, a thorough-bred, one of the best and most renowned, and, probably, the most successful, stock horse that was ever brought into the country. He was imported in 1791, a son of Mambrino, one of the most superb running horses ever on the English turf. Allusion has already been made to this horse, and to the celebrity and high reputation of his stock, or rather of the stock of his descendants in New England. It is, without question, one of the most valuable strains of blood that has ever been mixed with our stock, and though there are very few horses, at the present time, which can lay much claim to the name of Messenger from the amount of original Messenger blood in their veins, yet those that can be traced directly back to him still show some of his peculiarities, and the name is applied to them as well as to very many that have not the slightest claim to it from any strain whatever of Messenger blood.

The old Messenger was a gray horse with a large bony head, (a characteristic which he imparted to many of his descendants,) a straight neck, low withers, upright shoulders, nostrils and windpipe very fully developed, with legs, barrel, loins, hips, and quarters said to have been faultless. Among his immediate descendants which became celebrated in their day were Mambrino, Hambletonian, Messenger, Abdallah, and Engineer. The renowned Lady Suffolk, foaled in 1833, was sired by a great-grandson out of a great-granddaughter of Messenger. More than eighty of the horses entered for premiums or exhibition at the horse show at Springfield in 1860 were, or were claimed to be, Messengers. The genuine descendant of Messenger is usually a good-sized fast traveller and a tough, serviceable horse. A cross of the Morgan and Messenger, as in the case of the Hambletonians and other lines, generally combines, in a remarkable degree, the rare qualities of size, strength, and elegance of action. A good deal of the stock of such an origin has been noted for its good disposition, docility, and style.

It would be interesting to trace out in considerable detail the infinite intermixture of Messenger and other thorough-bred blood in our horses did space permit. The extent to which it has entered into our roadsters, if it could be fully known, would probably surprise those even who are well informed in these matters. It has been seen that Justin Morgan was half thorough-bred; Sherman, three quarters; Woodbury, one quarter; Bulrush, one quarter; and

Gifford five-eighths. No less than fifty of the best stallions named in Lindley's book are out of half thorough-bred mares, twelve out of quarter-bred, and others possess more or less of this strain of blood.

The celebrated Cock of the Rock, foaled in 1814 on Long Island, and taken to Vermont in 1820, where he was kept till 1828 or 1829, was sired by Duroc, and he by imported Diomed. His dam, Romp, full sister of Miller's Damsel, was sired by Messenger. He left a large number of valuable descendants in the western part of Vermont. Sir Walter, sired by Hickory, and he by imported Whip, was a most excellent four-mile racer, kept just over the Vermont line, in Canada, for many years, and left much good stock in that part of New England bordering on the Canadas, which flowed down through the Morgans and others. Quicksilver, sired by an Arabian, was kept in New Hampshire and sired the Carson horse and some others that obtained notoriety.

Young Hambletonian, sired by Bishop's Hambletonian thorough-bred, and he by imported Messenger, dam a granddaughter of Bellfounder, was, by Leonidas, bred and long kept in the western part of Vermont. He was fifteen and a half hands high, and is said to have been a remarkably fine horse and the getter of excellent stock, which was widely distributed in that section.

Barney Henry, sired by Signal out of a Messenger mare, was kept some years in Vermont, and got a great deal of most splendid stock. He was sixteen hands high, and weighed 1,150 pounds. Sir Charles, foaled in 1815, sired by Duroc, dam by Plats, and he from a Messenger mare, was long kept in western Vermont, and left a great deal of his stock there. The dam of Champion Black Hawk was sired by Cock of the Rock, grand dam by a Messenger horse. Trustee, the celebrated thorough-bred, imported in 1835, the sire of Fashion and the trotting horse Trustee, who performed the wonderful feat of trotting twenty miles in fifty-nine minutes and thirty-five seconds, has had some influence recently through his descendants in the stock of New England. The dam of the trotter Trustee was Fanny Pullen, a mare from Maine. And so of a long list of trotting horses more or less celebrated.

Allusion has already been made to the horses which ran in the eastern line of stages from Boston to Portsmouth and Portland, thirty or forty years ago, as having been celebrated for their excellence. Speed and beauty, great honesty, strength, and endurance, were found among them to a remarkable extent. I have taken considerable pains to ascertain where they were procured, and find that they were generally picked up in the northern parts of Massachusetts and Vermont, more especially in the western part, near the New York line, and a few in New Hampshire. Horses were not, at that time, so extensively bred in Maine as they have been since; but whatever may have been their origin, they and the stock from which they were selected formed a most admirable foundation for the exercise of skill in breeding. It was common for them to make the distance between Boston and Salem, fifteen miles, in an hour and a half in stages, before the railroad was opened, and ten or eleven miles the hour was generally required of the horses along the line, or nine miles the hour, including stoppages. A trot was generally sustained up hill and down, and the horses that could do it, and do it so well as those had the universal reputation of doing it, must have been good and the representatives of a good stock.

We might go even further than this, and say that they must have been naturally good and rapid trotters, for we know very well that no horse can be urged much out of his natural and easy gait and speed, and stand it well for any great length of time. A horse which could make only eight miles an hour without much exertion, and stand only that day after day, could not be put into a team making ten miles or eleven miles an hour and stand up under it six months.

Now, what could have been the origin and history of these horses? At a later period, after the time of many of the horses used as stock-getters, men-

tioned in the preceding pages, one might easily account for much of their excellence by ascribing it to their influence; but we know that very many of the horses to which reference is made could not have been descendants, or in any way related to such animals as Cock of the Rock, or to any of the celebrated sons of the old Justin Morgan, since they could have had but a limited and local influence on our stock previous to 1820; and we know that, with comparatively few exceptions, the breeding of horses was not pursued with anything like a system which could promise any very satisfactory results, even if we go so far as to admit, which was not probably the case, that the farmers generally of that time possessed a class of horses well adapted to the miscellaneous purposes and wants of the farm. No extra expense was usually incurred for what is now understood to be superior stock, and, as a general thing, very little care was taken to improve the blood, or to breed and raise horses for any special object, whether it were for farm-work, for the road, or the turf. In consequence, the horses did not possess marks of any distinct breed. Most of the horses on New England farms at that time would, no doubt, to an unpracticed eye, have been thought very ordinary beasts, and of little value. They were not groomed or particularly well treated in any other way; nor were they trained with anything like the care and attention that they now receive. Very little thought was given to regularity of feeding or to the comfort of the animal, either in the stable or out. If the horse took the family of his master to meeting, he did not always receive even Christian treatment when he got there, but was not unfrequently left exposed to driving storms or to the scorching rays of a summer's sun. There was a somewhat general impression that hard usage, by way of exposure, was the physiological way of toughening an animal, and the way very many of the horses, as well as other stock on the farm, were put through this process was little calculated to refine the animal system.

Besides this, the idea was very prevalent that oxen were by far more economical for work on the farm than horses, and it was, probably, in a great majority of cases, a very correct one. The broken and uneven surface of the farms in a great many parts of New England, making a slow gait and great strength in the working animal quite indispensable, operated very unfavorably upon the progress and improvement of the horse, while the low prices which horses generally brought previous to the time of the French revolution and the wars succeeding it left a much less margin for profit than has been the case within the last twenty or thirty years. There were no large establishments designed to improve and perfect this animal as there are now in many parts of the Old World; but more than this, more probably than all other causes put together to retard the developments of speed and pride in breeding, was the profound indifference to, not to say prejudice against, fast trotting in public, with the impression, for which there was no doubt good ground, that it led to gambling and dissipation, and the people were not of a character to permit even so desirable an agricultural improvement as the development of the good qualities of the horse at the expense of the public morals. I am not aware that any trotting course whatever existed in New England till within the last thirty years, and they have not been common till very recently. Racing horses and fast driving were checked at the very outset, for we find that as early in the settlement of the colony as 1672 the most stringent regulations were passed by the colonists in and about the precinct of Salem against racing and hard driving, especially on Sundays.

But under all these circumstances, which, however well in themselves, were certainly not very well calculated, one would suppose, to bring the horse to a very high state of perfection, our horses must have possessed many valuable qualities when considered from the point of general utility. They were trotters almost without exception after the introduction of light vehicles, and in that gait they probably excelled, even in the earlier part of the present century, the

horses of any other country, except, perhaps, the famous Orloff trotters. Low, in his *History of Domesticated Animals of the British Isles*, says of the people of this country what applied eminently to the population of New England: "They prefer the trotter to the pacer, more admired in the old continent; and having directed attention to the conformation which consists with this character, the fastest trotting horses in the world are to be found in the United States." But this is a remark made at a more recent period than that to which reference was more especially made, and it is based on the changes which have been effected in our horses since the interest and emulation in breeding began.

No improvement has been more marked in the character of our horses than the increase of speed. What would now be called fast trotting was not known at the time of the old Justin Morgan, nor had it ever been dreamed of as possible in the powers of the horse. Speed in the trotting horse, as already intimated, was not regarded as of any great money value till the invention of the modern light buggy and the general improvement of roads. The Narragansett pacer had made many a mile during the last century in a good deal less than three minutes, but that was a different gait and under the saddle. A horse that could trot a mile in three minutes forty years ago was the wonder of the neighborhood, but he did not bring much more in consequence of his speed. It is but little over forty years since a match was made against time with a wager of a thousand dollars that no horse could be brought forward which could trot a mile in three minutes. The money was won by a Massachusetts horse called Boston Blue in the year 1818.

There were, no doubt, very many horses at the period of which we are speaking that had the speed in them, but it had never been developed by training, simply because there was no special use for such extraordinary speed. It was not a safe rate of travelling over the roads of that time, nor would it then have served any practical purpose to be able to go over six or eight miles an hour under ordinary circumstances.

But speed in the horse has now become essential to the comfort and convenience of the people, and it commands its money value accordingly. The wants as well as the habits and tastes of the community have changed very materially since railroad travelling has become so universal. Men accustomed to a speed of from twenty to thirty miles an hour in the cars cannot be expected to content themselves with the old and common rate of five and six miles an hour; and the majority of people now want a horse to go off easily and without over urging at the rate of eight or ten or even twelve miles an hour, and the horses that do it are now very common, whereas formerly they were only the exceptions to the general rate of speed.

A demand soon creates a supply, and the farmer who breeds horses knows his own interest well enough to study the tastes of the community, and to breed up to them. In point of speed, therefore, there can be no question that a very great increase has been attained by more careful attention to breeding and training, particularly within the last twenty years. Speed is, to be sure, only one of the many qualities which are essential to a good roadster, and size, style, action, temper, form, constitution, and enduring qualities are equally important in making a general estimate of the character of the horses of this or of any other period.

With the exception of an increase of speed, it may well be doubted whether there has been any real and substantial improvement in the horses of New England within the last twenty years, which has been due to breeding especially. More care and pains are taken in the keeping and training, perhaps, and undoubtedly a larger proportion of really good horses are found now in comparison with the aggregate number, but for docility, power, and strength of endurance, and general good qualities, it is not probable that any very marked improvement has been effected. Still the aggregate money value has been greatly enhanced,

because the number of fast horses has increased, and speed will command its price. The tendency has been rather to congregate the best horses in and around the cities and large centres of population, perhaps, and to draw them from the country. Few farmers will keep a horse for farm and family purposes that will bring from two to five hundred dollars.

We come back, then, to the question of the origin of the horses of a class represented by the admirable roadster known in the many celebrated stage routes of New England thirty and forty years ago. Were they indigenous or imported? Did they come by chance from the earlier importations of the colonists, the horses brought by the company to the Massachusetts Bay in 1629, the Danish horses brought into New Hampshire in 1633, and some subsequent small importations into various sections? They were evidently a mixture of many different strains of blood, and that mixture was evidently made, in part at least, at a comparatively recent period.

It is highly probable that a large mixture with the French or Canadian horse had taken place. What was that? In the year 1604 some horses were taken from France—no doubt of Norman blood—into Acadia, and from thence to Canada in 1608, where they were kept quite distinct for many years, there being no other horses within many miles to mix with them. The Norman horse has long been noted as among the very best of French horses for the army service and for all kinds of draught. He may have been greatly changed from what he was two centuries and a half ago, but for a great many years he has been a large and powerful animal, extremely docile, and admirably suited to endure hard work and to live on scanty fare, considering his size. Many of the Norman horses have heavy heads; it may be called a prevailing fault among them. They constitute a most excellent foundation for the Canadian horses, which, even to this day, possess many of the characteristics and the sterling qualities of the Norman horse, with his toughness, power, and courage, though they have been dwarfed somewhat by the rigors of a northern climate, and perhaps, also, by a want of sufficient care and feeding. But the genuine French Canadian horse has many very excellent qualities, many of which would be highly esteemed in any class of horses, and which, for many purposes, would be considered quite indispensable, among which is a thorough adaptation to a severe climate, compactness of body, and a soundness of constitution which is unsurpassed. The close, compact structure of the body of many of our horses and of the Canadians appears to correspond, while much of the intelligence and fineness of head which often shows itself in our stock may be due to an infusion of thorough-bred blood. We know, in many cases that are very well authenticated, that where the genuine Canadian horse has been judiciously crossed upon our stock the progeny has given very great satisfaction. It is not unlikely that the Cleveland Bay, the Suffolk Punch, and some other strains of foreign blood have entered more than is generally supposed into the composition of our horses. We know that one or two Cleveland Bay stallions and several grades were sent to Massachusetts by Admiral Sir Isaac Coffin, and that a Suffolk cart stallion, five years old, was sent to the same State by Hon. John Coffin, of New Brunswick, in 1820. This horse, named Columbus, was bred in England. Bellfounder, imported by Mr. Boot, of Boston, about that time, was a Norfolk trotter, fifteen hands high. At five years old he trotted two miles in six minutes. Some of his colts are said to have been remarkable for speed and bottom. The trainer of one of them, a filly, said that her natural gait was three minutes, and that she made it many a time when he was breaking her, and that, too, under a tight rein.

But whether strains of blood flow in the veins of the New England horse the basis of his good qualities is due, in a great measure, to the circumstances in which the horses originally imported were raised and kept, that is to say, to climate and general treatment. The first horse introduced into New England,

as we have seen, arrived in 1629. Of that first importation one horse and seven mares survived. No doubt there were more or less later importations into the same colony. In 1635 there were thirteen mares and nine colts on the Piscataqua river, in New Hampshire. These were Danish, some of them having been brought over from Denmark a year or two previous, and they laid the foundation of the horses in all that section of country. It is said that distinct traces of that early Danish importation were preserved in more or less of the horses of that portion of New England down to a recent date, within the memory of those still living. What the Danish horses were two centuries ago it is impossible to say with certainty, but we know that for many years they have been large and powerful animals, easily adapted, with slight variations in breeding, to all the purposes for which horses are most wanted; while the horses of the immediate neighborhood of Holstein and Mecklenburg have long been celebrated for their large size, usually standing from sixteen to eighteen hands high, with a lofty and imposing action, and often possessing great strength and spirit. It is altogether probable, therefore, that the Danish horses first imported were large and fine animals. The Plymouth colony received horses at an early period after the settlement, though no mention is made of them till the year 1644. All these stocks were crossed and recrossed, probably, in every direction, according to accident and convenience. But to show the care taken to secure a supply of these useful animals, it may be stated that laws were passed prohibiting the exportation of mares from the colony as early as 1649, on pain of forfeiture. In 1668 the general court went to work in earnest to improve the horses of Massachusetts by an act citing that, "Whereas the breed of horses in the country is utterly spoiled, whereby that useful creature will become a burden, which otherwise might be beneficial, and the occasion thereof is conceived to be through the smallness and badness of stone horses and colts that run in commons and woods," &c.; and goes on to fix heavy penalties against allowing any full horse over two years old to run on any commons or woods unless he be of "*comely proportions and of good size, not less than fourteen hands high.*" The majority of the selectmen of towns to act as examiners, having full power to carry out and enforce the law provided to meet the case. The law also compelled the selectmen to attend to this duty under a considerable forfeiture to the county treasurer for neglect.

Now we know that the privilege of commons in the earlier history of the New England colonies was held in high estimation, and there can be little doubt that the present very general practice of castrating stud colts was introduced originally by law, possibly the very one alluded to, forbidding the use of commons to second rate whole horses. It is worthy of serious consideration whether, with no commons to use, and with our farms universally enclosed and generally very well fenced, it would not be better to save more horses entire, and thus preserve their natural strength and beauty.

This action of the general court of the Massachusetts bay, constituted as it was of the representatives of the people, is important, as showing a disposition, even at that early day, to prevent the deterioration, particularly in the size of their horses, and as calling attention of town authorities to the subject as one worthy of their most careful supervision. It also shows that the horses of that time were regarded as too small for the general wants of the people, and initiates a course of proceedings to improve and enlarge them. It also shows that the modern popular complaint of "too small," which has been very often urged against the present class of horses in New England, more especially against the Morgan and their descendants, is no new thing under the sun, but has been sounded over our hills for just about two hundred years.

It is better known at the present time than it was two centuries ago that the size of the animals of any section depends very much upon the fertility of the land, and especially upon the judicious care and feeding of the young stock.

These horses were left to browse in the woods and get their food whenever they could, exposed to the cold and storms of winter, often wholly unsheltered, and it is no wonder that they were small. But for the timely interference of the general court, no doubt they would have dwindled down to the size of the Canadian Indian pony.

Without special reference to the size of the New England horses which formed the basis of the modern improvements in breeding, it is reasonable, as already intimated, to refer very many of their characteristic qualities to the influence of climate, feeding, and to the services required of the animals through a series of years or generations. The New England horse has always been put to hard work and kept on hard fare, sufficient to break down animals of weak frame. Those which could withstand it without breaking down were, as a matter of course, of hardy, robust, sound constitutions, and such, after proving what they were, and having survived the hardships of our winters, our heavy teaming, bad roads, and short keep, were naturally the ones that would be put to breeding.

Then, again, horses raised on hilly and mountainous pastures early, and of necessity, acquire a sure-footedness, which they could not be likely to possess in so great a degree if raised under other circumstances. They have to be constantly on their guard. There are stones and stumps without number to be leaped, and the young colt in his playful sports, often running at full speed, has to avoid or leap them. He learns the free use of his legs much more surely than if trained through several generations on a smooth and even surface of country. This fact is to be taken into consideration, and to it some of the qualities of the horses of New England are to be ascribed.

Again: the treatment of stallions during the last and the early part of the present century was such as to try the character and constitution of the animal to its utmost, and to establish for him the reputation for endurance and strength, while it imparted great vital energy to the animal himself, and through him to his offspring. Most of the stock horses of those days were kept at work, and generally at hard work, for at least nine or ten months of the year. This, so far from proving an injury, was, probably, decidedly beneficial to such as could stand up under their work and keep in condition. At any rate, it served to establish the reputation of the animal for strength and hardihood for many miles around where he was usually kept, and his services would naturally be sought, rather than those of an animal that had not made such a reputation. In general, the horses on New England farms were not highly grained, except, perhaps, those kept at constant training. The farm horse himself was seldom grained at all, summer or winter, even when put to pretty hard work. Horses brought up in this way, if they exhibit any good qualities at all, will, when put to harder work on the road and grained and groomed, increase in spirit and activity, while others, pampered with high feed when young, will more frequently lose in these respects.

Horses bred in a region of small farms are more closely looked after, more frequently petted and handled while young, and thus get a kind of docility and hardiness from the first, while those bred under different circumstances are brought in with greater difficulty. Hence the horses of New England can hardly be said to require any training or breaking for ordinary purposes, and it is rare that, when harnessed for the first time at the age of three or four years, they refuse to go off as well and as steadily as older animals. I think this may account, in a measure, for the acknowledged docility, to be sure, and different dispositions in different families of animals of the same breed, and it may, perhaps, be said, with truth, of horses as of other farm stock, that training and proper management while young has as much to do with dispositions as any hereditary tendency.

And so of the gait of these horses, as the practice of travelling in the saddle ceased, owing to the improvement of our roads, and the introduction of light

vehicles, which offered the great advantage of carrying any light personal baggage with convenience, and enabling a single horse to accomplish double the amount of work by taking two persons instead of one, the trot became altogether the most desirable gait, as well as the most beautiful, and it soon came to be almost universal on the road. Pacing, which had been so highly esteemed in the saddle-horse, on account of its great ease of motion, was not well calculated for comfort in the chaise, nor, indeed, in the wagon or the buggy. Besides, the trot has always been allowed by professional equestrians to be the only true basis upon which the rider can attain a secure and graceful seat on horseback, combined with confidence and firmness, as he has more control over the motions of the body in that pace than in any other, since in it the body is brought well down into the saddle by its own weight, and finds the true equilibrium. It is because the trotting pace has been developed among us that it exists in so great perfection as to justify the high encomium of Professor Low, and the high reputation which the horses of New England bear in other parts of the country, and this development has been due to the universal necessity of the people for a useful kind of horse to travel over our roads. The art of training the horse to the trot or to any other gait, and developing all his powers in it, is far better understood now than it was forty or even twenty years ago, and the increase in speed has been to a great extent due to this source. Then it is a well ascertained fact that the exercise and development of any particular qualities or capacities in animals not only enables them to excel in them, but when this course is followed up those characteristics become hereditary, or at least are much more easily trained and developed in their offspring. There is another thing which has operated most powerfully on the general improvement of our horses, especially in their speed, and that is, the high prices which they have commanded during the last few years. The profit made in producing first-class animals has been great, and the stimulus it has afforded to skill in breeding has been of itself sufficient to account for much of the progress that has been made. Professed breeders and other public spirited individuals have spent money without stint to procure the very best animals of their class, especially mules, and the community has had the benefit of the improvement to be derived from the use of such animals.

As auxiliary to this the establishment of tracks by State and county agricultural societies in nearly all parts of New England, for the purpose of affording facilities, by trials of speed or otherwise, for exhibiting the good points of young horses, has encouraged the production of a higher quality by the prospect of getting more nearly the true value of colts after they are raised. That the course adopted by these societies has stimulated effort and awakened a greater interest in this branch of farming industry is sufficiently shown in the increasing numbers of horses exhibited from year to year, and in the warm competition that the exhibitions have called forth. The result of this general interest has been the production of a great many very valuable animals, and an increase of speed in many cases, while the general average goodness of horses has been elevated, that is, there are many more really good and fast horses, in proportion to the aggregate number, than formerly.

As already intimated, it is the practical good qualities of the horse that give him value, in the vast majority of cases, to the New Englander. The capacity to travel well ten or twelve miles an hour on the road, or to perform well as a horse of all work, is what is most commonly wanted; yet, in the matter of fast trotting, the horses of the eastern States have of late years taken a deservedly high rank.

In 1843, Beppo, sired by Gifford, a Morgan, trotted with Independence mile heats, best three in five, and made the remarkable time of 2*m*. 32½*s*.; 2*m*. 31½*s*.; 2*m*. 33*s*.; 2*m*. 38*s*.; and 2*m* 35*s*. It was, at that time, the fastest trotting on record.

It was a Vermont horse, "Fanny Jenks," that performed the wonderful feat, in 1845, of travelling one hundred miles in 9*h.* 43*m.* 57*s.*, without showing signs of distress. She was but 14¾ hands high, and weighed but 935 pounds. The year previous to this remarkable performance she had trotted ten miles in harness before a sulky, carrying 145 pounds, in 29*m.* 59*s.*

In 1847, Lady Sutton, bred and raised in Vermont, sired by Morgan Eagle, beat Gray Eagle in two-mile heats, in harness, in 5*m.* 17*s.*, and 5*m.* 21*s.*; and, in 1848, she beat handsomely in the celebrated contest with Lady Suffolk and Lady Moscow, making the best mile in 2*m.* 33*s.*

The renowned Trustee, who performed the unparalleled feat of trotting twenty miles in 59*m.* 35½*s.*, was out of a mare, Fanny Pullen, that was raised in Maine. This great trial came off on the 20th of October, 1848; the horse trotting the whole distance without once breaking up, and making his last mile in 2*m.* 51½*s.*

In 1849, Mac, a horse raised in Maine, won several matches against some of the most celebrated animals on the course; twice beating Lady Moscow, four times winning against Lady Suffolk, twice against Jack Rossiter, and others. He made his mile in 2*m.* and 26*s.*, and his two miles in 5*m.* 9*s.* The dam of Mac was probably a descendant of Messenger, and his sire a Morgan, which has generally proved to be a most excellent cross.

In 1851, Tacony, another Maine horse, beat War Eagle twice, though he was still quite young, and in 1852 he won twelve times, beating all the best trotting horses of his time—Lady Suffolk, three times; Lady Brooks, four times; Zachary Taylor, four times; and many others. He made his best mile in 2*m.* 26*s.*, and others in 2*m.* 27½*s.* and 2*m.* 28*s.*; and his two miles, under the saddle, in 5*m.* 2*s* and 5*m.* 5*s.*; and, in harness, in 5*m.* 7¾*s.*

In 1853, Ethan Allen, a Vermont horse, then less than three years old, beat Rose of Washington, in three straight heats, in 2*m.* 42*s.*, 2*m.* 39*s.*, and 2*m.* 36*s.*; making the fastest time on record of any trotting stallion of his age at that time.

In this year, also, Mac made the best time, 2*m.* 25½*s.*, at two miles, repeated in two consecutive heats, being a minute better than Lady Suffolk had made. Miles were trotted in that year in 2*m.* 27*s.* no less than seven times, showing a decided gain in speed over any former period.

From year to year the speed of New England horses has been gradually increased, or if the time of any one has not been excelled, there have been a larger number which have either come up to it or shown faster time than they had hitherto done; showing a general and progressive increase in this important quality till, in the year 1861, Ethan Allen outstripped himself, surpassing the best time that Flora Temple had previously made, and making his mile in 2*m.* 19½*s.*

It is very clear, therefore, that there has been a very decided increase of speed within the last few years. Now, as to the oft-repeated complaint of undersize against many of our horses, it is not so clear that much of it is not open to that objection, if it is viewed with reference to many of the purposes for which horses are liable to be wanted. But when such a complaint has been made against any particular class of New England horses—like the Morgan, for instance—without any reference to the objects and purposes for which they are used, and for which they are most admirably adapted, it is simply absurd. If it is asserted that the Morgan, or any similar class of horses, is undersized for a truck or draught horse, it is no doubt true; he is not bred for that purpose.

The careful development of speed for the purpose of improving the roadster has been attended with complete success. If it could be shown that we have been breeding chiefly for show, instead of service, and that in the development of the speed of New England horses the far more important qualities of strength of constitution and power of endurance have been sacrificed, it would be a just cause of alarm, and it would appear to be quite time to begin a radical but

gradual change, and to look more to size and weight. But this is not the case generally and without qualification, though it is perhaps true that an undue attention has been paid to breeding roadsters and light, active carriage horses, while other kinds of horses have excited less attention, or have perhaps been positively neglected.

It is generally conceded that a medium-sized horse is, on the whole, the most desirable as a horse of all work, and a medium size will range from fourteen and a half to fifteen and a half hands in height. Horses less than that in height will be found too small for general purposes, though many exceptions will be found among the Morgans, owing to their great power and other superior qualities, in proportion to their size. Many short-legged horses have possessed remarkable speed. Flora Temple, for instance, is but fourteen and a half hands high, and her weight not far from eight hundred pounds; and yet, notwithstanding her small size, it is said that her stride, when going at full speed, measures sixteen feet.

The weight of a good roadster may vary from nine hundred and fifty to eleven hundred pounds. There are many horses in New England under a thousand pounds, but probably quite as many which are over that weight. For ordinary purposes on the road, and for general work, from ten to eleven hundred pounds is heavy enough. A larger sized horse would not be found so serviceable in horse-cars, omnibuses, or hacks, and certainly not in the buggy or light carriage. A heavy horse will not wear so long over the hard-paved streets of a city as a medium-sized one. That, I think, has been sufficiently demonstrated by the last few years' experience, and the practice conforms to it, as we see small, quick, tough horses almost universally preferred for these purposes.

If heavier horses are wanted for special purposes, they can be had in any numbers. There is ample material for increasing the size. We often want horses to plough, for instance, and small or undersized horses are too light for the furrow, or the furrow is too heavy for the team. When the team cannot carry a deep furrow without an extra strain or draught too great for it to travel with as a team and keep up a good gait day after day, it shows a want of weight to throw into the collar, and such work would soon break down the team. The eyes of the skilful breeder are very speedily opened by an active demand for animals of greater size and weight, and such a demand cannot long remain unsupplied.

To increase the size judiciously will require the use of larger, better developed, and more roomy mares than the average of our fast roadsters. It is not so essential that the stallion should be very large. He should not be larger than the mare, though a decidedly undersized one should be avoided. Both animals should have a relative adaptation to each other; that is, there should not be a very great disproportion between them. Great contrast in character, especially a disproportion of size on the part of the male, has almost invariably led to disappointment, while a sort of equilibrium of good qualities in both animals has generally produced a superior progeny.

But all attempts to increase the size of horses, as of other farm stock, will prove fruitless, unless the young, growing animal is better cared for and furnished with a full supply of nutritious food. No animal can easily recover from a stinted growth while young, and the development of the frame will usually be in some proportion to the abundance of food.

But with regard to the Morgan, against which the complaint of undersize is most frequently and persistently urged, it may well be doubted whether they could be very greatly raised up without destroying their peculiarities as Morgans, and thereby inflicting an irretrievable injury upon them as a class. When the time arrives for New England to dispense with the horse of all work, it may do to give up that spirited, nimble, hardy, and docile animal, with its iron con-

stitution, its ability and its willingness to work, year in and year out, at every and all kinds of work which can be put upon it.

The New England farmer will probably come more and more hereafter to the practice of breeding for special purposes, and give up the idea of combining every quality in one animal. Breeding roadsters is successful and profitable in many localities, and some will continue to pursue it. Breeding stylish carriage horses may be made equally profitable if judiciously undertaken, and there is always a demand for heavy, slow twelve and fourteen hundred pound horses for teaming about railroad stations, in trucks, and in heavy farm work.

But horses from eleven to twelve hundred pounds weight make extremely useful animals for labor; and if to this size a good form, a good constitution, good spirit, and good courage can be added, qualities which in themselves would not appear to be incompatible, we have a splendid animal. All these qualities are often united, and all of them, except the size and weight, may be found every day and met almost every hour on the road in any New England town. Having superiority of form and points which secure good action, strength, and endurance symmetrically combined, we have beauty as a matter of course, and beauty always commands a fancy price.

With regard to the number of horses in New England, the United States census of 1850 contains no trustworthy information. That of 1840 did not enumerate the horses separately, horses and mules being included in one class, while, for some reason or other, the *horses owned and kept in cities* were not returned in 1850. The returns of horses in Massachusetts will illustrate the position in which the census leaves us in regard to any information worthy of confidence. The returns of 1840 give the number of horses and mules in Massachusetts as 61,484. In 1850 the number of horses, asses, and mules is stated at 42,250, and the horses alone as 42,216. Now, this would lead a person to suppose there had been a great falling off in the number of horses in the State, and, by a natural inference, in the breeding of this valuable animal. But the facts are, that in 1850 there were, in Massachusetts, 74,060 horses, instead of 42,216, and the number had increased in 1860 to 90,712, showing an increase of more than twenty-two per cent. in the horses of Massachusetts alone, and the proportional increase in the other New England States is probably quite as large as in Massachusetts.

Any statistics of the horses of New England drawn from the United States census, therefore, would be calculated to mislead; and as the official returns of the various States are not at hand, it is impossible to state, in detail, either the present number or the relative increase during the last ten or twenty years.

TROPICAL FLORIDA.

BY L. D. STICKNEY, FORT MYERS, FLORIDA.

THAT portion of Florida south of 27° of latitude has generally been believed to be covered by swamps and everglades, and unfit for cultivation; but it has been found by actual reconnoissance to contain large bodies of high land fit for agricultural purposes, and equal to any in the State for fertility.

The climate of this region is more uniform than in any part of the continent, or than any country in the same latitude not similarly situated in contiguity with the Atlantic ocean and the Mexican gulf, being too remote from the north

to admit the dominion of the cold winds to prevail long enough to produce any sensible effect, while its proximity to the tropics affords the mild and refreshing coolness of the trade-winds.

The soil is generally light, and will not bear many exhausting crops, such, for example, as sugar, without manures, but in no country are the means of improving land more available; lime, marl, argil, silica, and humus, are abundant and accessible to all. By a skilful combination of these, compost can be formed adapted to any land—suitable to make poor land rich, and to keep it so. The rivers abound in fish; the lagoons bordering on the ocean supply turtle and oysters; the earth produces the *coonte* and the cabbage tree, and the forests are alive with wild deer and other game. Food is everywhere within reach, and can be produced with the least possible exertion.

The writer about ten years ago purchased an extensive tract of land on the Caloosahatchee river, one hundred and twenty miles north of Key West, and engaged in the culture of tropical plants. The point selected, Fort Myers, had, during the Indian wars, been occupied by the United States troops as a military post. The officers stationed there caused about fifty acres to be cleared, fenced, and planted in a variety of tropical plants. The orange, lemon, and lime trees have come into bearing, producing abundantly. The Sicily lemon transplanted there is much improved from the original. In this locality the cocoa-nut, date, guava, pine-apple, banana, plantain, sappadillo, tamarind, alligator pear, sugar apple, grape fruit, arrow-root, cassava, ginger, and coffee, are all growing, and might be successfully cultivated to supply to the States of a colder latitude much of those productions which are now imported from foreign countries, thus forming highly important additions to the agriculture and wealth of the Union.

Live-oak, yellow pine, cabbage tree, and mangrove are the most abundant forest trees, though formerly a good deal of fustic, mahogany, lignumvitæ, and braziletto were to be met with; but these valuable species of timber have been so much in demand for ship-building and commerce that trees of any size are rare. The most formidable obstacle the farmer meets in preparing ground for cultivation is the saw palmetto, (the *Chamærops serrulata*,) with plaited palmate fronds and sharply serrate stipes. The roots cover the surface of the ground, and are removed by the slow process of the grubbing-hoe. Several species of this genus of palms afforded the Florida tribes food, wine, sugar, fruit, cabbage, fans, darts, ropes, and cloth. Some have good fruit, like plums; others austere, like dates. They are now chiefly used to make hats, fans, baskets, and mats, with the leaves.

The land bordering on the Caloosahatchee river and its tributaries is accessible by vessels drawing not more than six feet; contains enough live-oak to supply the navy of the United States for a quarter of a century. Other valuable timber for ship-building is found in the same locality. Such being the natural advantages which invite enterprise to this quarter, there can be no doubt that when its agricultural resources are more generally understood, southern Florida will be covered with a dense population of thrifty farmers. Cuba, with almost a corresponding climate, has several hundred plants which serve as a basis to her agriculture, such as grains, farinaceous roots, edible seeds, vegetables, salads and sauces, fruits; the great staples of exportation—sugar, coffee, and tobacco, plants for dyes, yielding oil, suitable for cordage or cloth, yielding gums and resins, good for tanning; grasses; and woods employed in various uses. Now, it is well known that most of the productions of Cuba are growing in south Florida, and, with cultivation, might be made to rival those of that celebrated island. Sea Island cotton of a fine quality has been produced in the very centre of the peninsula. Florida surpasses Cuba in variety and delicacy of vegetable culture. At all seasons of the year beets, onions, egg-plants, carrots, lettuce, celery, &c., are produced with the most indifferent culture, while everything that grows upon vines is in abundance and in great perfection.

Cabbages and Irish potatoes, if planted in October, produce well. The former have been grown at Fort Myers, a single head weighing forty pounds. Cattle, hogs, and poultry increase astonishingly. Until the rebellion of the slave States, south Florida supplied the Havana market with beef at the rate of one thousand head per month; besides, considerable quantities were shipped to the Bahamas, Key West, and Tortugas.

WHEAT-GROWING IN PRUSSIA.

LETTER FROM THE UNITED STATES MINISTER AT BERLIN.

UNITED STATES LEGATION,
Berlin, April 15, 1862.

SIR: I have this day forwarded to Hamburg, to be shipped to the United States, addressed to the agricultural division of your department, a box containing two samples of the best white winter wheat grown in the kingdom of Prussia.

FRANKENSTEIN WHEAT.

The sample marked No. 1 is known as Frankenstein wheat, and was grown in the province of Silesia, near the city of Breslau, one of the chief seats of its culture in Prussia. The soil in which this variety was cultivated contains considerable magnesia, and clay predominates.

CUJAWISCHER WHEAT.

That in sample No. 2 is called Cujawish wheat, and was grown in the province of Posen, near the river Vistula. The soil was an alluvial formation, varying from heavy clay to loose humus and sand. Here, out of its particular home, it does not thrive very particularly well unless the original seed is frequently renewed.

Some information as to the mode and manner of wheat cultivation in Prussia and its results may, perhaps, be interesting, if not useful, to the agriculturist of the United States, and to that end I have availed myself of the best means of information within my reach, as well as of the statistics compiled from the information of practical agriculturists.

THE CULTIVATION OF WHEAT IN PRUSSIA.

Species of wheat.—By the different methods of cultivation and the influences of climate and soil more than two hundred varieties of wheat have been produced from the original species. They are divided, according to the color of the grains, chiefly into white and colored; according to the formation of the ears, into eared and bearded wheat. There is another discrimination between common wheat (*Triticum vulgare*) and cone wheat (*Triticum turgidum;*) the former has oval-shaped grains, with ears smooth and four-sided, or furnished with spears starting out irregularly on all sides. The latter has seeds of a rounder shape, and the ears contain invariably beards running parallel in four straight rows. Common wheat yields more and better flour than cone wheat. Each variety is variable; it is changed by the climate and the influences of cultivation.

CLIMATE AND SOIL.

The northern limit of the cultivation of wheat is the sixty-fifth degree of the north latitude. The more temperate the climate is, the more clay should the soil contain. The cultivation of wheat is impracticable on grounds having more than fifty per cent. of sand. An admixture of phosphate and sulphate of limes makes the soil fitter for the raising of wheat; but soil containing iron or turf is not fit for it. All kinds of soil containing acid reagents can, by drainage, be made fit for the raising of wheat, if containing sufficient clay and humus. In the vicinity of the sea-shore, on islands, wheat grows also on sandy soil. England owes the extent of her cultivation of wheat less to the physical condition of the land than to the fact that the climate is always moist and moderate.

TILLAGE.

Wheat requires always a loose, deep ground, cleared of weeds. It is not good to work it too finely. Fresh, strong manure from stables does not agree well with it. From fresh stable manure wheat often acquires diseases, a tendency to rust and blight, both of which consist of mushroom parasites, injuring the grains and the quality of the straw. As manures for wheat, guano, ground bones, chilese sulphur, lime slaked in the air, and wood ashes, are very serviceable. These manures are applied at the rates per Prussian acre (180 square perches) as follows:

	Cwt.
Guano	1½ to 2
Ground bones	2½ to 4
Chilese sulphur	1 to 2
Lime	10 to 24

Wood ashes may be applied in any quantity, but they must not be ploughed in, but spread over the surface and harrowed in after sowing.

Fresh stable manure should be ploughed in lightly in the spring; two or three weeks later the field should be fully harrowed, and after another week or two deeply ploughed up. If it is very heavy or full of weeds, it must, before the planting takes place, be ploughed as deep as the ordinary furrow. Five to six and a half tons stable manure is a sufficient quantity to a Prussian acre; cattle and horse manure mixed is the best; sheep manure is not so good, because it exercises a bad influence on the quality of the grain.

The sowing time in Germany is from the beginning of September to the end of October, and one to one and a half bushel are sown broadcast to the acre. The grains are harrowed under equally, or by sowing-machines covered with soil one or two inches deep. Drill cultivation, also, is suited to wheat. Drill-machines sow it in furrows usually nine inches broad, which, when the plants come up in the fall and spring, are by soft instruments covered loosely with soil. With drill cultivation fifty per cent. less of seed will suffice. As there is no botanical difference between winter and summer wheat, they are drilled in the same manner, with the difference only that the former is sown in the fall, the latter in the spring, when night frosts are no longer to be feared. If the wheat field is very heavy, and exposed to the winter wet, it is ploughed in beds six to twelve feet in width.

WINTER WHEAT.

The greatest care must be taken that the field be properly drained, particularly in the winter, after a heavy rain or a sudden thaw, that no water remains anywhere on the surface. If with an early planting, and in consequence of warm weather and heavy manuring, there is danger of the seeds in the fall, it must be remedied by pasturing sheep, but never cattle, on the field after dry

and light frost. In the spring it is better to cut off the tops of the green wheat with the sickle, whereby care must be taken that only the tops of the leaves are cut off, but that the stalks which are already developed are spared as far as possible. If in the spring the plants stand thin and poor, they must be helped by a slight manuring on the surface of guano or chilese sulphur. If the soil is argillaceous, and the winter moisture has not been properly carried off it is well to thoroughly harrow the field as soon as it will bear cattle when the weather is warm, or is expected to be so. By that means the field comes quickly into reciprocal action with the atmosphere, warms more quickly, and the seeds bear good stems. If the soil is weedy, then it must be weeded before the stalks become set.

HARVEST.

The harvest should begin when the greatest part of the grains are still soft. If they are allowed to come to maturity, the husks become heavy and hard, the wheat yielding much flour, and that of inferior color, besides a great diminution of ripe grains ensues. Only such wheat as is designed for seed should be allowed to come to maturity on the stalks. Such seed only should be used in sowing. In countries where the straw is of no value for agricultural purposes or for sale the ears are cut off, and the straw remains on the field, either to be ploughed under or to be burned. Wheat is mostly cut off closely over the soil with sickles, or scythes, or mowing-machines, and immediately made up in bundles weighing twenty pounds or so, and placed in two rows, in the form of a roof, one against the other. So it remains on the field till grain and straw are wholly dry, so as to be threshed on the spot, or to be carried into barns, or put up in stacks. The greatest care should be taken that the wheat is put up as equally and compactly as possible, so as to prevent injury from fermentation by the access of air. The most desirable shape for the stacks that remain in the open air is the cylindrical or oblong, but the latter must be arranged so that the smaller side is exposed to the weather. As a basis, a row of straw or brushwood two or three feet deep is spread out, and upon it the wheat sheafs are laid horizontally, with the ears inwards, and the ends where the wheat has been cut outwards. When a suitable height has been reached, it is covered up with another layer of straw, in order to carry off the rain water quickly and surely. Wheat is threshed by threshing-machines, or flails, or by cattle.

YIELD OF CORN AND STRAW.

Under this head, beyond the statistical tables which follow, little need be said. The weight of the Prussian bushel of wheat differs from eighty-two to ninety-six pounds, on the average only eighty-six. Wheat-grain consists on the average of sixty per cent. starch flour, thirteen per cent. gluten, two per cent. dextrine, eight per cent. husk, two and a half to three and a half per cent. vegetable, white and grease, and fourteen per cent. water. At normal harvests one hundred pound sheaves yield generally thirty pounds of grains to seventy pounds of straw; at poorer harvests, forty pounds of grains, sixty pounds of straw. On very grassy soil, which usually yields more straw but less grain, the proportion between the latter and the former is often as twenty-five to seventy-five. To a bushel of grain straw and chaff weigh as follows: on dry ground, one hundred and fifty-seven pounds; on fresh ground, one hundred and seventy-two pounds; on wet grassy soil, one hundred and eighty-six pounds—at an average, therefore, one hundred and seventy-two pounds. A soil for the cultivation of wheat, when properly dressed and well manured, yields to the Prussian acre (equal to one hundred and eighty square perches, the perch equal to one hundred and forty-four square feet) thirty-five hundred weight, of which ten to twelve hundred weight are grain, twenty-five to twenty-three hundred weight straw.

GENERAL REMARKS.

Wheat should not be sown on the same place at too short intervals. This, however, does not apply to very rich low countries, where, either in consequence of former inundations or by reason of regular returning ones, as in the Theiss, in Hungaria, and on the Nile, alluvions or depositions have been formed or are still forming. Not only a diminution of the quantity, but also of the quality is the consequence when wheat is too often sown on the same soil.

The following is the most usual rotation of crops:

	On very strong soil.	*On a medium soil.*	*On poor soil.*
1.	Rape, manured.	Rape, manured.	Wheat, manured.
2.	Wheat.	Wheat.	Potatoes or the like.
3.	Clover.	Oats.	Clover.
4.	Beans, manured.	Beans, manured.	Clover.
5.	Wheat.	Wheat.	Clover.
6.	Oats.	Clover.	Rye.

The best kinds of German wheat are the Frankenstein (Silesia) and the Cujawe; the color is almost white, but when planted in another region the color becomes darker and the yield of grain is diminished.

STATISTICS.

The proportions of nutriment in wheat, according to Growen's Lecture on Agricultural Chemistry, Cologne, 1859, are as follows:

	Per cent.		*Per cent.*		*Per cent.*
Sanguificative substances, (Prostein,) about	13½	Rye	11⅕	Oats	11⅕
Fat substances, (Prostein,) about	2	Rye	2	Oats	6
Carbon, about	66½	Rye	64½	Oats	56
Hydrogen, about	14				
Ash, about	2				
Filaments, about	2				

The equivalent of nutriment in wheat is 31.5 per cent.; of rye, 29.9 per cent., and of potatoes, 7.5 per cent.

As in France and England chiefly wheat is used, and rye and potatoes only to a small extent, the greater amount of sanguificative substances the two nations consume in comparison with the Germans is so striking that possibly we may infer from it the fact of the quicker blood and more excitable temper of the two nations.

The consumption, on the average, is per head—

In Prussia: Wheat, about 105 pounds; potatoes, about 1,248 pounds.

In France: Wheat, about 232 pounds; potatoes, about 270 pounds.

Production.—Official statistical reports of the whole quantity of wheat produced annually in Prussia do not exist at all, because all experiments to fix the quantity have remained without result; but it is thought an approximate estimate may be made from the following official notices:

According to an official statement, there were at the end of 1858 in Prussia 2,121,385 estates, with an area of 93,126,300 Prussian acres, and at the end of 1851 there were in Prussia 11,990 manors, with an area of 24,950,654 Prussian acres.

Agricultural pursuits are followed for a livelihood, 1st, as principal business by proprietors, farmers, and their families, as well as their laborers, to the number of 5,878,437 persons; 2d, as a subordinate occupation by farmers, their families, and laborers, to the number of 2,177,322: both together by 8,055,759 persons.

From this and other incidents the average produce of a harvest in Prussia is estimated (though still very vaguely) at about 20,000,000 bushels of wheat, 66,000,000 bushels of rye, 55,000,000 bushels of oats, 150,000,000 bushels of potatoes.

According to official reports, the average produce of wheat has been during the last ten years, (1851–1860,) in the various Prussian provinces, as follows:

		Per cent.
In the province of	Prussia	0.93
	Posen	0.84
	Pomerania	0.95
	Brandenburg	0.89
	Silesia	0.89
	Saxony	0.88
	Westphalia	0.92
	Rhine province	0.92
	Hohenzollern	0.89

On the average, therefore, 0.89, against that of rye 0.87, barley 0.85, oats 0.88, potatoes 0.70 per cent.

This result is not favorable for the agriculture, and would be in contradiction with the rising of the value of estates, if it did not appear the better part of the soil had been used for other purposes, as, for instance, the cultivation of red beet, &c.

Last year (1860) showed a better result, as follows:

Provinces.	Grains.	Straw.
	Per cent.	*Per cent.*
Prussia	1.12	1.16
Posen	0.91	0.95
Pomerania	1.02	1.10
Brandenburg	0.87	0.84
Silesia	0.87	0.91
Saxony	1.06	1.05
Rhine province	0.95	0 87
Westphalia	1.02	0.99
Hohenzollern	0.91	0.80
On an average	0.97	0.95

According to official tables, the yield of wheat and straw was in 1860, in the various provinces, as follows:

Provinces.	Bushels of grains, per acre.	Pounds of straw, per acre.
Prussia	10.15	1,980
Posen	7.57	1,920
Pomerania	9.99	1,813
Brandenburg	8.08	1,786
Silesia	7.04	1,667
Saxony	10.32	1,813
Westphalia	9.24	1,627
Rhine province	10.15	1,621
Hohenzollern	10.41	1,411
On the average	9.22	1,737

Prices.—The average price of wheat in Prussia has been, per bushel:

	Silver groschen.	*Pfenning.*
1850	58	7
1851	62	11
1852	72	2
1853	86	1
1854	108	5
1855	119	5
1856	113	6
1857	85	6
1858	76	3
1859	75	0
1860	88	0

According to the latest official communications, the price of wheat in the large cities in the different provinces of Prussia, on an average, in August, 1861, was as follows, per bushel:

		Silver groschen.
In the province of	Prussia	$78\frac{1}{12}$
	Posen	$77\frac{11}{12}$
	Brandenburg	$84\frac{11}{12}$
	Pomerania	$89\frac{3}{12}$
	Silesia	$77\frac{10}{12}$
	Saxony	$91\frac{1}{12}$
	Westphalia	$103\frac{1}{12}$
	Rhine province	$107\frac{6}{12}$

In the eight provinces together, on an average, $88\frac{3}{4}$ silver groschen per bushel.

Table of the rate per head.—The consumption of wheat in Prussia in the under-named years:

	Lbs.	*oz.*
1852	108	26
1853	95	25
1854	88	24
1855	98	4
1856	96	27
1857	117	1
1858	123	2
1859 and 1860	(No reports.)	

The consumption in the various provinces separately, per head of the population, was as follows:

		Lbs.	*oz.*
In the province of	East Prussia	132	7
	West Prussia	120	21
	Posen	107	27
	Pomerania	99	25
	Silesia	93	12
	Berlin, (city)	88	0
	Brandenburg	86	13
	Saxony	78	9
	Rhine province	74	11

In the whole state, on the average, during the years 1852 to 1858, 104 pounds 2 ounces per head of the population.

According to an approximate estimate, (the correctness of which cannot be guaranteed,) the money value of the whole net proceeds from agriculture in Prussia are placed at about 583½ million thalers;* the proceeds from wheat being placed at 6.23 per cent. of the above sum, which would be 36.4 million thalers.

Imports.—Prussia imports wheat chiefly from Russia and Poland. She imported, in 1858, 2,169,000,000 bushels; in 1859, 1,280,000,000 bushels. The principal buyer of wheat from Prussia is England.

Exports.—According to an average account of five years, Prussia has exported to England annually—

	Imperial quarters.	*Prussian bushels.*
1831 to 1835	113,000, or	597,790
1836 to 1840	526,000, or	2,782,540
1841 to 1845	652,000, or	3,449,080
1846 to 1850	567,000, or	2,999,430
1851 to 1855	702,000, or	3,713,580
1856 to 1860	723,000, or	3,851,120

The greatest export to England from Prussia was in 1853, 1,145,000 imperial quarters, or 6,056,050 Prussian bushels; and in the year 1860, 1,149,000 imperial quarters, or 6,078,120 Prussian bushels.

Placing the Prussian bushel last year at the average price of 88 silver groschen, the quantity exported to England shows a value of 17,829,152 thalers, or £2,641,355$\frac{3}{7}$ sterling.

The average prices of wheat during ten years in Prussia, compared with those of England and France, in bushels and silver groschen, (30 silver groschen equal to 1 Prussian thaler,) are as follows:

Year.	Prussia.	England.	France.
	Silver groschen.	*Silver groschen.*	*Silver groschen.*
1821 to 1830	57.00	111.70	80.87
1831 to 1840	58.08	107.95	83.48
1841 to 1850	70.42	100.72	86.81
1851 to 1860	88.75	105.46	98.16

Since the corn laws in England have been abolished, and the corn duty moderated to one shilling per quarter, the exports to England have increased in the same ratio as the price of wheat has fallen there and risen in Prussia.

It is natural that the difference of the price between Prussia as a producing and England as a consuming country does not constitute the net profit; but that the charges for transport, insurance, commissions, and other expenses, which can be estimated at about 12 to 14 shillings per quarter, must be added to it, so that it will amount per bushel to about 23 to 25 silver groschen, or about 55 to 60 cents per quarter, 5.29 bushels (Prussian) being equal to the imperial quarter.

I am especially indebted to F. Platho, esq., a banker in this city, and director

*The thaler being 71.7 cents, this amount in United States currency would be $418,369,500.

and treasurer of the Acclimatization Society for the Royal Prussian States, for valuable information connected with wheat-growing in Prussia.

Respectfully,

N. B. JUDD.

The COMMISSIONER OF PATENTS,
Washington, D. C.

THE DAIRY FARMING REGION OF GREENE AND ORANGE COUNTIES, NEW YORK,

WITH SOME ACCOUNT OF THE FARM OF THE WRITER.

BY ZADOCK PRATT.

[Furnished at the request of the Secretary of the Interior.]

THE dairying regions in this country, in which butter-making has been carried on most successfully, there is probably none that excels, in peculiar adaptedness for the purpose, that belt of territory varying from twenty-five to fifty miles in width, which begins with Orange county, near the city of New York, and extends from the Hudson river in a northwestwardly direction, perhaps one hundred or one hundred and twenty-five miles, into the heart of the State.

In this belt of land the county of Greene, *as a whole*, is not embraced. It is a country which nature has favored, to say the least, with a due proportion of mountains and rocks. Of its area, which is stated at 686 square miles, or about 440,000 acres, there were returned by the census of 1855—

Acres of land improved	212,224
Acres of land unimproved	150,604
	362,828

Leaving more than one-sixth of the total surface unaccounted for among its wild acclivities and lofty summits. The bluffs that overlook the river; the parallel ridge of hills beyond; the Catskill range along the southern border stretching away into the county of Delaware; the branches of this range, occupying most of the west and northwestern parts of Greene, with their connecting highlands and frequent spurs, combine to break up nearly its whole territory into a rough succession of picturesque heights, not too storm-beaten or bare of soil to nurture the trees of the forest; or hill-side pastures not too steep and stony for grazing purposes, and now and then compelled to yield their quota of Indian corn or oats, with occasionally a crop of winter grain. Along the streams, moreover, there are alluvial flats of some extent, well enriched by the wash of the mountains, but the grass that grows upon the heights themselves is thought to be sweeter and more nourishing for cattle; and it is a matter of some doubt whether, in proportion to the pecuniary value at which they are rated, the flats can be farmed by the dairyman and grazier at any greater profit than the hills. And it should be added, as generally characteristic of the latter—those of the greatest

Figure 1.—*View of the dairy farm of Hon. Zadock Pratt, Prattsville, New York. Area*, 365 acres.

Figure 2.—PLAN OF THE ABOVE FARM.

Scale, 4 inches to the mile.

REFERENCES.

a, a. Barn-yard.
1, 1. Sheds and pig-pens.
2. Horse and wagon house.
3. Barn, 30 by 40 feet; stable in basement; elevated entrance to left.
4. Door-yard.
5. Wash and wood house.
6. Milk-house, cement bottom.
7. Dwelling-house.
8. Water-tanks.
9. Granary.
10. Corn-house.
11. Water-pipes to yard and pens.
12. Buttermilk pipes to pig-pens.

SIZE OF LOTS.

No. 1, 11 acres; No. 2, 16 acres; No. 3, 17 acres; No. 4, 36½ acres; No. 5, 14 acres; Nos. 6 and 7, 45 acres; No. 8, 7½ acres; No. 9, 6 acres; No. 10, 11 acres; No. 11, 203 acres.

height probably alone to be excepted—that their summits are found perhaps equally as productive as their sides.

While the immigrants who, at a very early period, settled the immediate banks of the Hudson river, were slowly finding their way along the water-courses into the interior, others, following up the course of the Schoharie creek, were penetrating from the Mohawk, on the northward, into western and north-western Greene, and before the revolutionary war the lowlands in that corner of the county which looks out upon Delaware in front and Schoharie on the right had already been dotted over with the homes of these sturdy pioneers and farmers. In process of time the extensive hemlock forests that covered the mountain lands attracted thither a new and thriving business; tanneries sprang into existence along the streams, and the bark-peelers and teamsters engaged in this employment, and the large amounts of money constantly diffused in wages, made the whole region one of active and prosperous industry. Over the road leading back from the village of Catskill through Prattsville, in the extreme northwestern portion of the county, came, moreover, a considerable portion of the travel and traffic from middle and western New York to the Hudson, particularly the droves of cattle, before the days of the railroads; stage-coaching was here found in all its glory, and the taverns with which the roads were lined were as sure to be as full and busy as the coaches themselves.

After the hemlock forests were cleared away, it became necessary to test the capacity of the land for production of another kind; and although the amount of grain it yields has not been equal to the home consumption, its grasses, as already intimated, at once proved well adapted either for curing or for pasturage. Within a feasible distance from the river, for carriage thither, hay has therefore been an important crop in the townships, for example, of Coxsackie, Catskill, Greenville, and New Baltimore; Coxsackie and New Baltimore have also sent to market considerable quantities of potatoes, and all the towns mentioned produce more or less butter. As we recede from the river, however, the advantage of dairying, as compared with selling hay, increases. A half cent per pound for the transportation of a firkin of butter is not felt to be quite so serious a tax as fifty cents per 100 pounds on a bale of hay! According to the census of 1855, the towns producing proportionately the most butter were, in the order named, Prattsville, Jewett, Lexington, Halcott, and Ashland, all of them in the western part of the county.

And here it is that, by penetrating into the county from the Hudson river at Catskill, winding up over and down the noted mountain range from which this village takes its name, striking the Bataria Kill, and following its narrow gorge into the townships of Ashland and Prattsville—here it is that we may fairly regard ourselves as entering upon the great butter-making region referred to at the beginning. And, whether fancifully or not, there are some of the old tanners who maintain that of all this region it is the *hemlock lands* which prove the best for butter-making and are capable of imparting the sweetest and richest flavor. The founder of Prattsville village, from whom it takes its name and to whose farm this article particularly relates, was himself engaged for many years, and very extensively, as a practical tanner. During the period embraced between the 24th of October, 1824, when he first located and began to build on the Schoharie Kill, and the autumn of 1845, when the Prattsville tannery was closed, he had consumed, in his operations there, one hundred and fifty thousand cords of bark, paying therefor half a million of dollars; had employed the services of about thirty thousand men, and paid over two and a half millions of dollars for labor, and had turned out a million sides of sole leather from the products of the forests which once shaded more than ten thousand acres of land. Having thus done his best to harvest and convert into form for human use the crop sown by nature over these mountains and valleys, it seemed to

him almost a matter of duty to replace the hemlock, if possible, with other crops; to render the land not less productive in cultivation than it had been as a wilderness, and to apply the same rule in farming which had been the guide of all his undertakings in tanning, namely, "to do one thing at once, *and to do it well.*"

It is true that the stranger to this part of Greene county and to the butter region lying beyond, whose ideas of *all* good farming are indissolubly associated with fields of smooth or gently varied surface, clad in unbroken herbage, or tilled to garden cleanliness, will find such anticipations most rudely shocked if he does not leave them behind him before crossing the Catskills. The steepness of the hill-sides will be suggestive to him of anything rather than the successful employment of the plough, let alone the cradle or the reaper; and the vast collection of mineralogical specimens of every size and form, cropping out, undetached from the everlasting foundations underneath, or scattered in loose masses, just where the primal convulsions of mother Earth may have left them, will scarcely seem to him indicative of the real richness and abundance of the feed with which, in summer, the hill-sides and almost the stones are actually covered.

To those who have not visited the locality under description it is well to recall these facts, because it ought always to be borne in mind that the farmer's great object everywhere is to ascertain what is, and to be sure that he grows intelligently, "*the right crop in the right place;*" and it is the conclusion reached by Colonel Pratt's long experience and observation, that if greater attention was paid to the natural adaptabilities and requirements of different localities, in all cases, our farming, as a whole, would be far more intelligently and successfully carried on than it now is. The manufacture of butter to the best advantage appears to depend upon a peculiar combination of climate, soil, herbage, and atmosphere, with an abundant supply of pure, soft, cool water. Then Colonel Pratt's first object is to "get a *good thick sod* on the land," and thus "you may have wealth at home and money in the bank." During one season a side-hill lot on his farm, three acres in extent, lacking fifteen rods, yielded no less than *twelve tons* of hay, showing that *there*, at least, the rocks cannot have been very seriously in the way.

After these preliminary remarks, which will serve, it is hoped, to convey a general idea of the region in which Colonel Pratt's farm is situated, we come to the farm itself, of which a map (Fig. 2, p. 413) is given herewith, together with a view (Fig. 1, p. 412) showing the buildings in perspective. The farm contains 365 acres, 40 of which are fine alluvial soil, the residue what is called hemlock land, (loam and gravel,) lying on the eastern slope of the Catskill mountain. As already intimated, the hemlock was originally cut for the purpose of obtaining the bark for use in Colonel Pratt's tannery, and the land afterwards cleared up, seeded down, and fenced with stone wall, of which about *five miles* have now been laid; and the whole converted into a dairy farm, upon which fifty cows have been kept throughout the last five years.

Accurate accounts have always been kept of the management, products, and expenses of this farm, a summary of which, in the most concise form possible, is presented in the following table:

Statistics of Hon. Z. Pratt's dairy farm for the usual season of about eight months for the years 1857, 1858, 1859, 1860, *and* 1861, *fifty cows of what are called native breed being kept each year.*

	1857.		1858.		1859.		1860.		1861.	
MILK.	*Pounds.*	*Gallons.*	*Pounds.*	*Gallons.*	*Pounds.*	*Gallons.*	*Pounds.*	*Gallons.*	*Pounds.*	*Gallons.*
Whole product	254,736	31,842	260,450	32,556¼	240,700	30,087	217,736	26,276	227,757	28,301
Average per cow	5,094.48	636.31	5,209	651.12	4,814	601.74	4,354.75	525¼	4,555	572.26
Average per day	1,044	130½	1,067⅓	133.4	982¼	122⅔	888.72	107.28	876	108.85
Average per day per cow	20.80	2.60	21.30	2.70	19.65	2.45	17.77	2.14	17.5	2.17
Greatest av'age in one day per cow	24.18	3.25	31.50	3.31	28.35	3.53	25.60	3.40	26.7	3.37
BUTTER.		*Ounces.*		*Ounces.*		*Ounces.*		*Ounces.*		*Ounces.*
Whole product	6,500		8,050		8,300		9,143		10,860	
Average per cow	130		161		166		182.86		217.20	
Average per day	26.61		33		33.92		37.72		41.76	
Average per day per cow		8.50		10.56		10.84		11.94		13.36
Average milk to 1 pound of butter	39.20	Or 20 qts.	32.33	Or 16.16 qts.	29	Or 14.50 qts.	23.30	Or 11.20 qts.	21	Or 10.42 qts.
PORK.	*Per cow.*	*Total.*	*Per cow.*	*Total.*	*Per cow.*	*Total.*	*Per cow.*	*Total.*	*Per cow.*	*Total.*
Pork made in pounds	92¼	4,627	148	7,403	129	6,455	130.3	6,516	132½	6,625 00
SALES.										
Butter sold	$30 95	$1,547 54	$38 48	$1,924 02	$41 40	$2,070 00	$42 97	$2,148 89	$49 91	$2,497 80
Pork sold	6 56	328 16	8 42	421 08	8 36	418 00	9 12	456 12	6 62	331 25
Calves sold								80 00		38 65
Total	37 51	1,875 70	46 90	2,345 10	49 76	2,488 00	52 09	2,685 01	56 49	2,867 70
Expenses for working farm over proceeds of same not enumerated above, including $700 for each year for int. on investm'ts for farm and stock, $10,000		1,415 50		1,380 50		1,550 00		1,125 75		1,150 75
Net profits above interest		460 20		964 60		938 00		1,559 26		1,716 95

From this table it will be noticed that the production of butter per cow has shown a regular and gratifying increase during the past five years, until it has now reached an average of 217$\frac{1}{5}$ pounds for each of the whole fifty head—an unusual amount even for a small dairy; and it is, of course, much easier to make the average a large one where a few select animals are chosen than it is to obtain the same average throughout a dairy of such extent. It is also shown that each cow has given during the past season over *two and a quarter tons* of milk in weight, and yielded a gross pecuniary return of *nearly fifty dollars*.

In regard to the increase manifested during the season of 1861 over that of 1860 in the yield of butter, namely, from 182 pounds per head in the one to 217 pounds in the other, an increase not far short of 20 per cent., it may be remarked not only that the character of the past season itself has been remarkably favorable, more butter than usual having been made by dairymen generally, but also that Colonel Pratt, in pursuance of his idea that it is the *best milkers which must yield the most profit*, in all the new purchases that have been made, has been careful to select the best cows he could find for dairy purposes, only about thirty out of the fifty cows milked in 1861 having formed a part of the herd in 1860.

Entering the farm by a substantial gateway, (see Fig. 3, annexed below,)

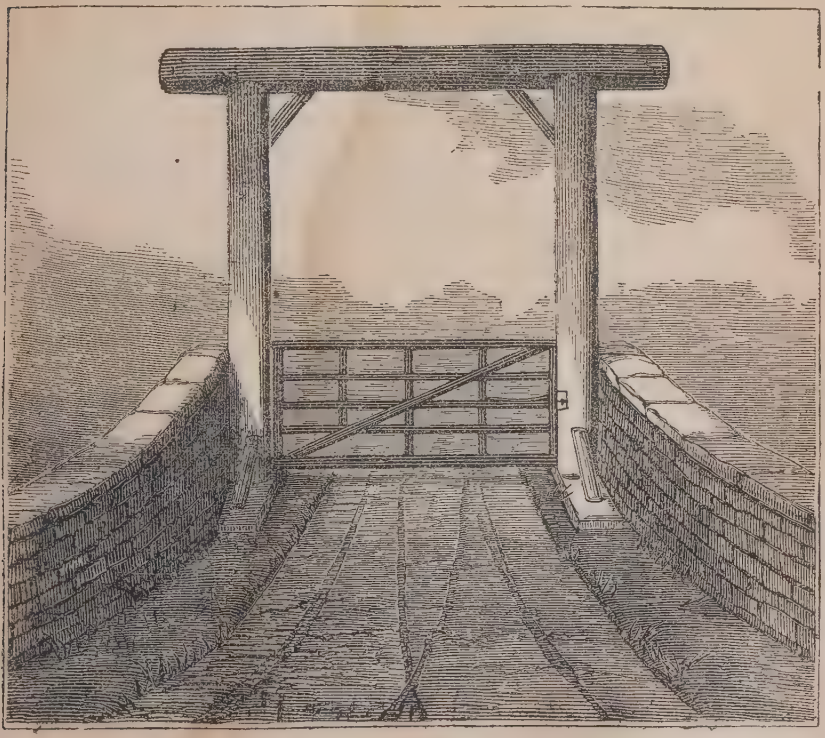

Figure 3.—*Gateway; main entrance to Colonel Pratt's farm.*

we pass one or two others on our way to the farm buildings, finding them all of a similar permanent and thorough-going appearance with that of which the above engraving is given. The engraving also shows the neatness and strength with which the stone wall upon the farm has been laid up. Approaching the farm buildings from the rear, (see engraving, Fig. 4, page 418,) we notice the artificial reservoir, constructed both for the supply of the buildings and as a

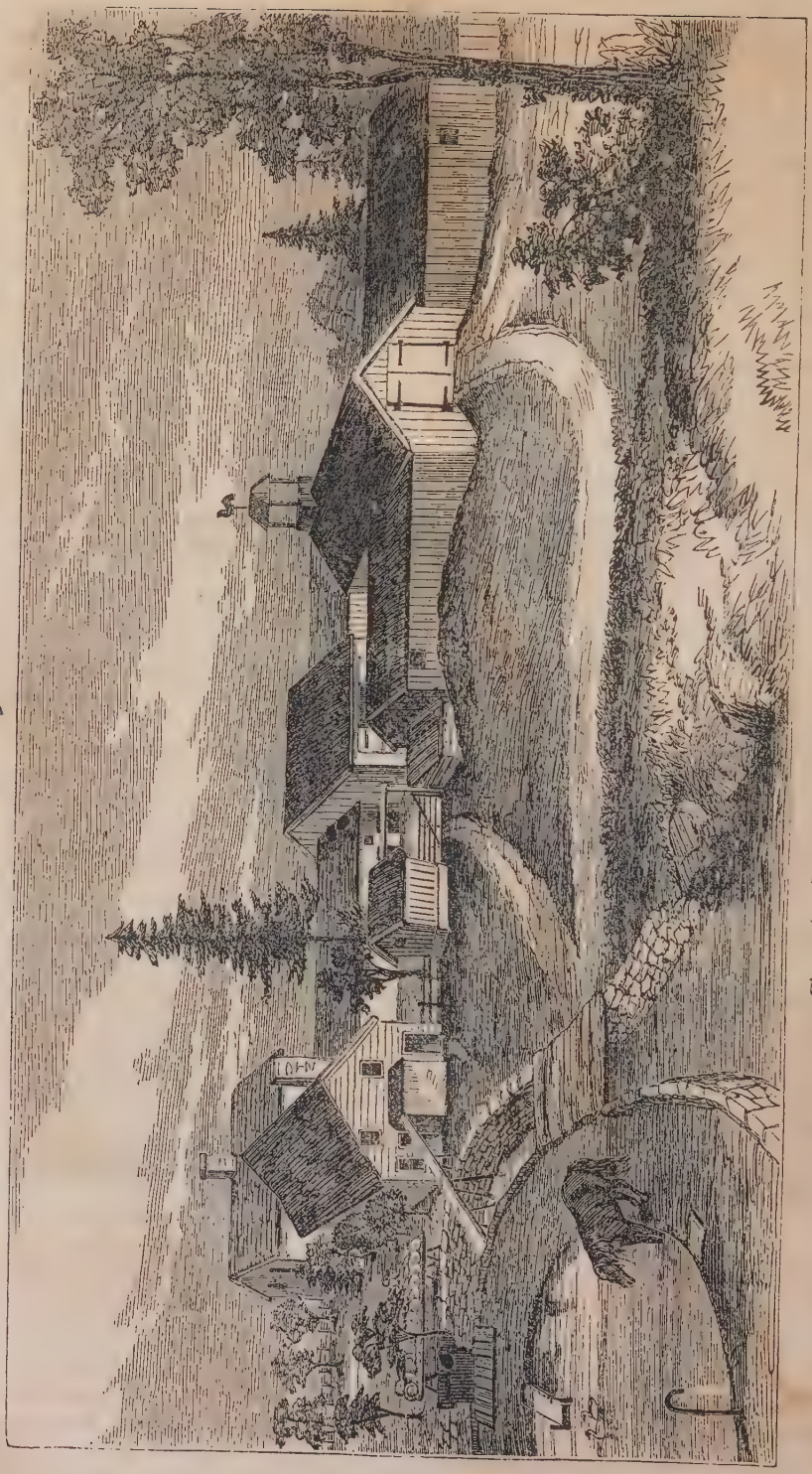

Figure 4.—*Rear view of Colonel Pratt's farm buildings.*

means of power in churning. The water comes from a spring above, and is also carried down by subterranean pipes to the dairy.

THE MAKING OF GOOD BUTTER,

although in reality quite simple, is something which proves very puzzling to many people, if one may judge from the many different grades of this article which are offered in our markets, and the varying prices which our farmers receive for the products of their dairies. The following description of the system adopted in Colonel Pratt's establishment is therefore presented, beginning with the feed given to the cows, in the hope that if it contains nothing that is particularly novel to old and long-experienced butter-makers, it may yet furnish some useful hints to younger aspirants for success in this important branch of northern farming.

FEEDING THE COWS.

The feed given to the cows has been two quarts each per day of a mixed provender, consisting of one-third each of corn, oats, and buckwheat, ground together; hay also being supplied from February until the 10th of May; then grass alone until September 1, when corn sown broadcast for forage began to be fed, and afterwards pumpkins, both of which latter were found to add to the quantity and heighten the flavor and color of the butter.

MILKING THE COWS.

It is important *always* to treat milking cows with kindness; blows and harsh words have as much effect in rendering them ugly as they would probably have upon children or human servants. Especially at milking it is well never to forget that gentleness is an essential requisite; as far as possible to have the same milker always attend to the same cow, and in any case to have the operation *thoroughly* as well as kindly completed. By attention in these respects, "spilt milk" is an almost unheard-of phenomenon here; the cows are, moreover, always milked in the stable, with a feed before them, and *with great regularity*, at 6 o'clock morning and evening the year round. No one of these items should be overlooked.

CARRYING IN THE MILK.

The maids who do the milking are not bothered to carry in the milk as fast as a pail is filled; but some one else, generally the farm manager himself, replaces the full pail with an empty one, carrying in the milk and registering its weight. It is then strained from the pail into a large can, stirred around with a long-handled ladle until the foam disappears, and then ladled into the pans. Two points are here worth noting particularly:

1. If the milk is strained directly into the pan the eye alone will be depended on as to the quantity poured in, and the foam gathered on the surface is thought to be just so much in the way of the rising of the cream.

2. The milk of different cows will differ somewhat as to the time required for the perfect rising of the cream; more careful watching is therefore necessary as regards each separate pan, if the milk is set separately, than if that of several cows is so intermingled before setting that the cream on all must rise alike.

SETTING THE MILK.

Tin pans are used of what is there commonly called an "eight-quart size." But on trial we found the pan actually to contain about seven quarts; it is large

in diameter, with flaring sides. The quantity ladled into each pan varies; in hot weather two and a half quarts, and in cooler weather three quarts. These exact quantities were decided upon after careful trials with greater and smaller quantities had shown conclusively that the most cream was thus obtained, and they are now adhered to with scrupulous accuracy. In cool weather the milk may stand longer than in hot weather without danger, consequently it will bear to be a little deeper. In the pan containing two and a half quarts the milk stands only *one and a quarter inches in depth;* in the pan containing three quarts it is one and a half inches deep. This is a very strong argument in behalf of *shallow setting*, the practice referred to having been closely followed for two years past, and, as is thought, to very great advantage.

TIME TO SKIM THE CREAM.

If the milk fairly begins to be thick at bottom it is thought ready to skim. It may be allowed to stand until it can be cut with a knife all through, but there is great risk in too long standing; if it once begins to turn partly to water, the cream will have a bitter taste that can never be overcome.

TEMPERATURE.

The temperature of the milk room is kept at as nearly 62° the year round as possible, and probably runs from that point to 65°, or in very warm weather perhaps to 70° or 72°, but the latter are only exceptional cases.

CHURNING.

The churning is done in two barrel churns, the dashers of which are moved by an overshot water wheel, of perhaps fourteen feet diameter, just outside the churn room. The quantity churned at once is thirteen to fourteen gallons, yielding from thirty to thirty-three pounds of butter in each churn. In hot weather the temperature is carried down if possible to 61° at starting, by means of ice, as the agitation of the milk with the warmer atmosphere will heighten this temperature somewhat before the butter comes; but 62° is thought to be just the right point if it can be got and maintained. Cold water may have to be put in to regulate the temperature during churning, but this is not done unless absolutely necessary.

THE BUTTER

is now taken from the churn and washed generally three times, or until the water no longer brings away any buttermilk. It is next weighed, and salted with the best Ashton salt, sifted and accurately weighed out in the proportion of an ounce to a pound of butter. The only exception to this rule is in very hot weather, when a slight addition is made to the quantity of salt, to replace what will be dissolved in getting out the last of the buttermilk, say twenty-one ounces of salt to twenty pounds of butter. After salting, the butter is put in pans on the cool stone floor of the butter cellar, where it stands four to six hours before the last of the buttermilk is worked out, after which it may again stand until the next morning before packing.

PACKING THE BUTTER.

The new firkin has a pail of boiling water thrown into it, which remains there until cool; brine is then substituted, which is allowed to stand for a day or two before the butter is packed. When filled with butter a cloth is spread over the

top, and a layer of coarse Turk's island salt, washed clean, placed upon the cloth. Temporary tops for the firkins are made of *round, flat stones*, which are laid over them from the time the butter is packed until the firkin is finally headed up to go to market. These stones are thought to keep the temperature cooler and more even than any other cover. The firkins, it should be added, stand upon a wooden floor resting upon joists, or upon the joists themselves, so as to let the air pass underneath them.

MARKETING.

It has been found the neatest way of marketing to take off the salt from the top of the butter, turn down the firkin to let the brine drain off, and then replace the cloth, wrung out in brine. As to the keeping qualities of the butter there is never any difficulty; its character the season through is remarkably even; the first time, for instance, of sending a lot to New York last spring, April 2, seven firkins were sent, of which three were new, and the other four kept over from the preceding fall. The butter dealer was afterwards asked if he had been able to detect any difference between them; but he had not, the whole selling as spring-made butter.

RELATIVE WEIGHT AND STRENGTH OF THE MILK.

It has been matter of curiosity to note the variations at different times in the relative weight and strength of the milk. The following statement shows the quantities required to make a pound of butter, and the weight of milk per gallon, as recorded for the first day of each month in 1860 and 1861, the milk of the one day being kept separate and the butter weighed by itself:

	1860.		1861.	
	Quarts to make one pound butter.	Weight per gallon.	Quarts to make one pound butter.	Weight per gallon.
May 1	12.96	7.91	11.20	8.02
June 1	11.43	8.28	12.40	7.74
July 1	12.14	8.30	10.74	8.03
August 1	11.35	8.66	10.45	8.28
September 1	11.83	8.09	9.94	8.12
October 1	9.28	8.53	8.85	8.07
November 1	8.21	7.56	8.50	8.12
Average of above seven days by themselves	11.03	8.19	10.29	8.05
Average of whole season, as per statement given on page 416	11.20	8.28	10.42	8.05

OTHER FARMING MATTERS.

The importance of *having a good sod* has been already referred to. With this end in view, and in order to insure a good grass crop the first year after sowing, the following method is adopted: When the land is seeded with a winter crop, from fourteen to sixteen quarts of timothy (or herds grass) are sown in autumn, and in spring clover-seed is also sown, in April if there should be a late snow on which to sow. The proportion of the clover-seed to the timothy is about as three to five.

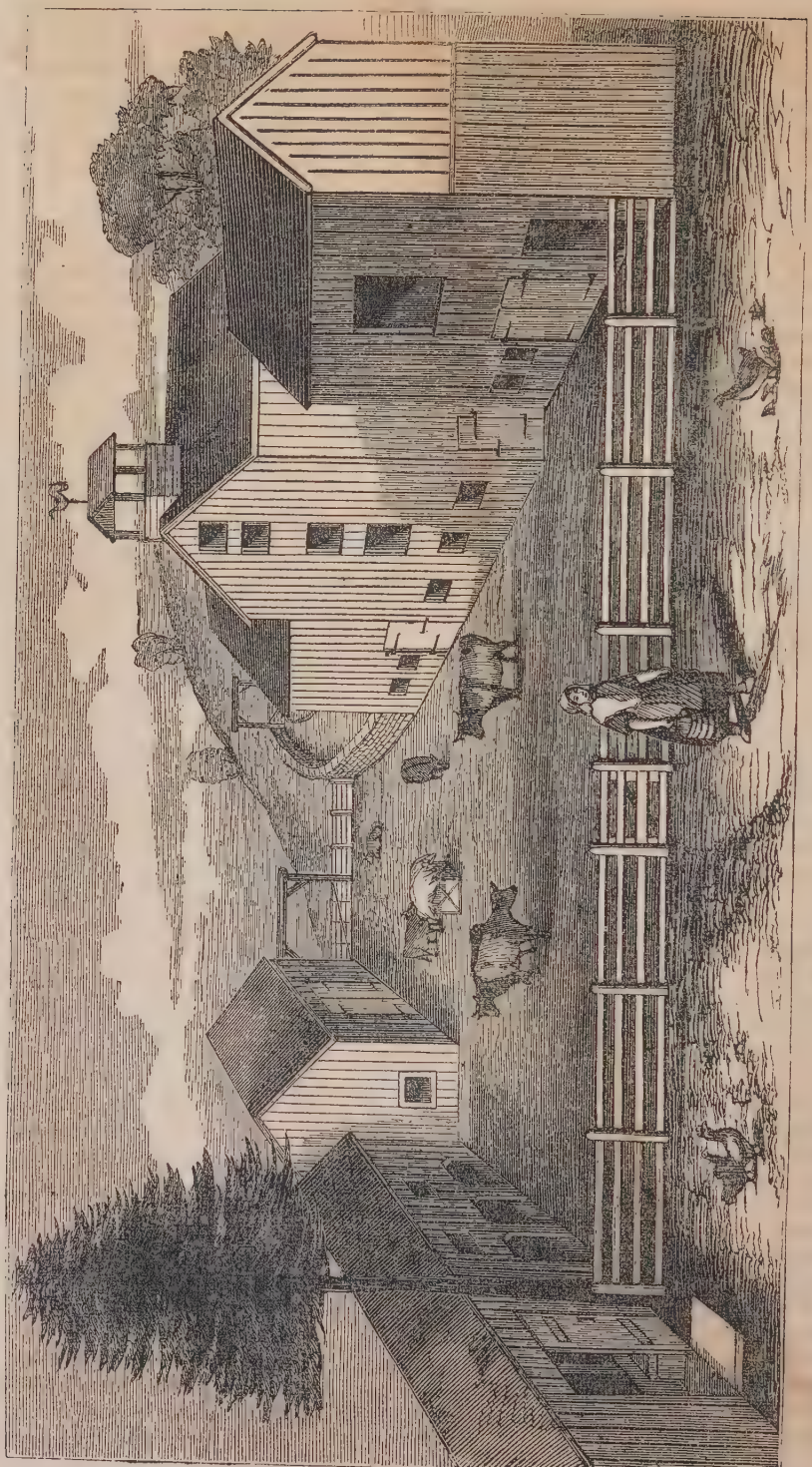

Figure 5.—*Barn yard.*

The other crops of the farm for the past two seasons have been:

Crops.		1860.	1861.
Corn	bushels	367	579
Oats	do	150	.....
Rye	do	100	.....
Turnips	do	1,200	400
Potatoes	do	.....	140
Carrots	do	.....	1,100
Buckwheat	do	.....	111
Cornstalks	tons	49	60
Pumpkins	loads	70	110

The proceeds of the corn crop for the two years were:

1860.—367 bushels, worth here 87½ cents	$321 13
70 loads pumpkins, worth here $1 50	105 00
Total	426 13
1861.—579 bushels, worth here 75 cents	$434 25
110 loads pumpkins, worth here $1 25	137 25
Total	571 50

And the foregoing totals may be considered as so much *net gain* from the land under the corn crop, as the cornstalks, not included therein, are considered to have been more than an equivalent for the labor expended upon its cultivation.

CONCLUSION.

One word, in conclusion, as regards the FARM BUILDINGS. The farm manager who, with his wife, superintends all the operations of the dairy, occupies a dwelling from which he can overlook the whole farmstead, (see Fig. 5, p. 422,) while the dairy adjoins him, with neat and capacious milk, churning, and packing rooms, (see Figs. 6, 7, and 8, pp. 424, 425, 426,) and a cool, sweet storage cellar, into which nothing that can taint the air is ever permitted to come. The water is turned on to the wheel which supplies the churning power from a reservoir on the hill-side above by pulling a wire, without leaving the house. Pure spring water for all the requirements of the establishment is also brought in by pipes. Adjoining, in the rear, is a building devoted to the pigs, for whose benefit the skimmed milk and buttermilk is carried by a wooden channel from the churn room along the passage way in front of their styes, so that a simple slide will admit it at pleasure into each. There is a young orchard on the hill-side near by of over a hundred and fifty apple trees, recently set out for the benefit of the stock.

The aim in conducting this farm, in which the efforts of its proprietor are fully seconded by those of his active and intelligent manager, has been *to do everything well* when it is undertaken at all, and to test fairly and fully the butter-making capacities of such a farm under such a system of management. It is expected to enlarge the number of cows from time to time hereafter, the object hitherto having been to enlarge the production of those that were kept

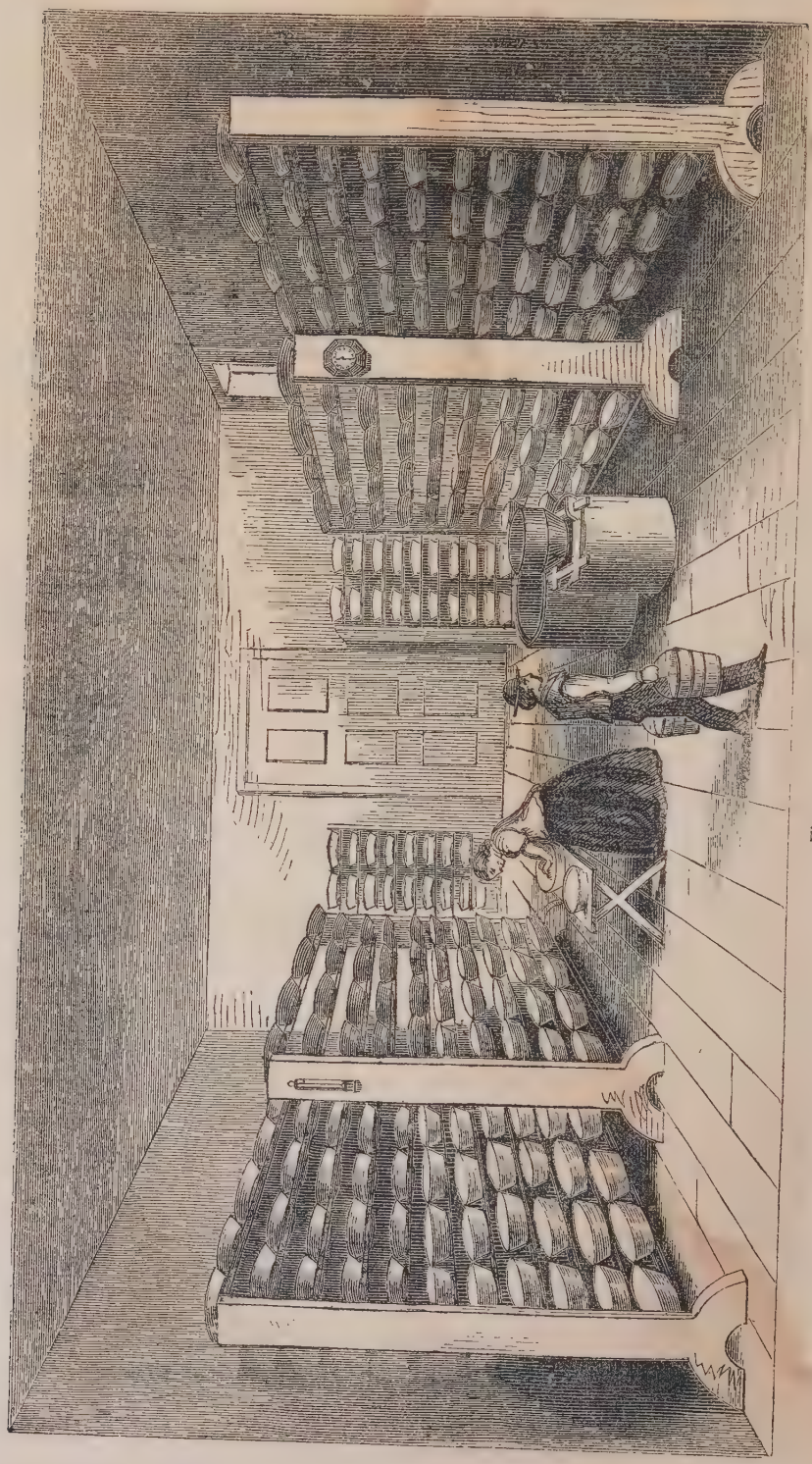

Figure 6 — *Milk room.*

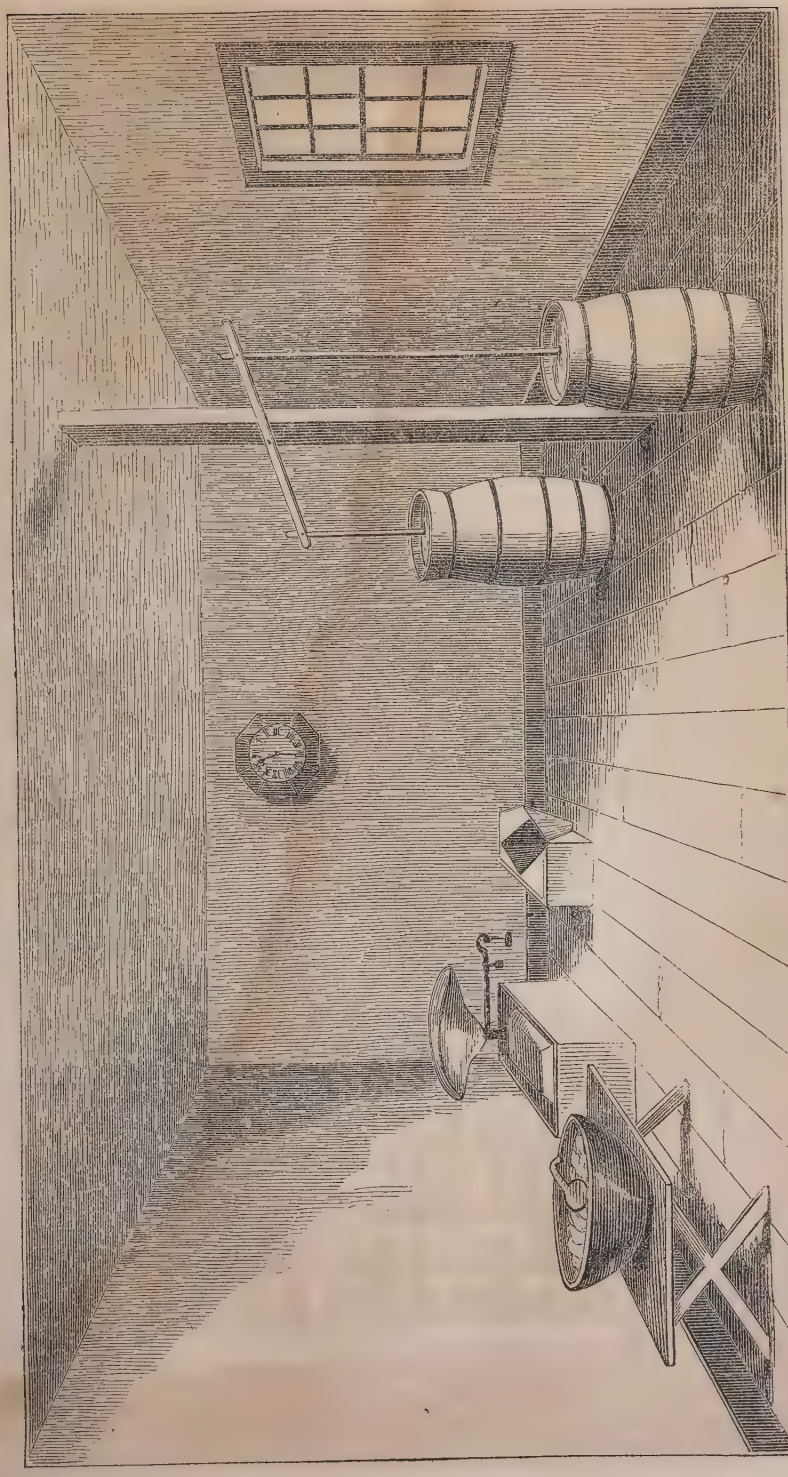

Figure 7.—*Churn room.*

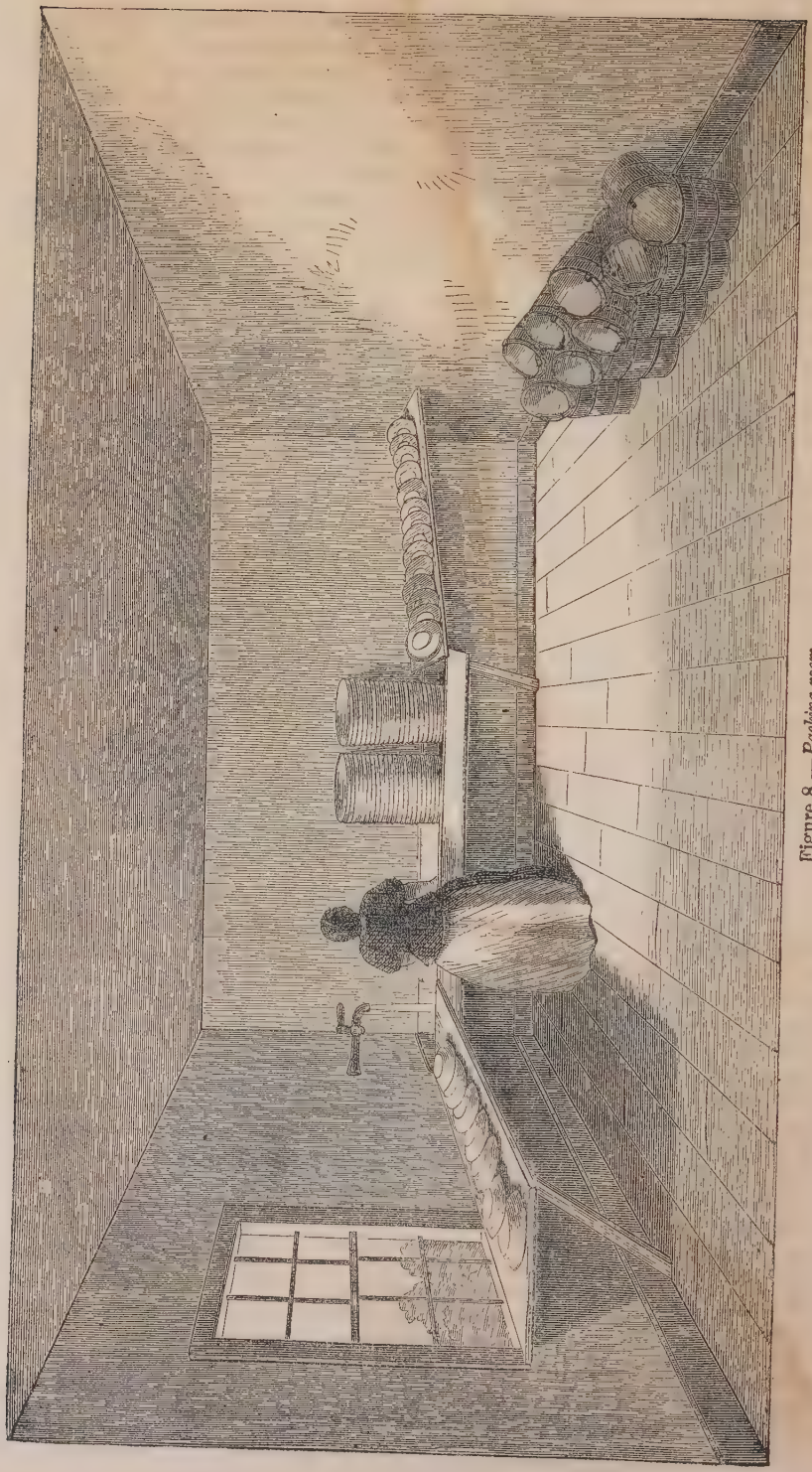

Figure 8.—*Packing room.*

to its fullest extent before increasing their number. The manager of the farm thinks he can now keep more cows, and still maintain the average production of each. Indeed, the condition of the farm has been so much improved, under liberal manuring and good management, that he expresses entire confidence in its ability to sustain a dairy of seventy cows with less difficulty than it did fifty three years ago, and in its ultimate ability, if it continues to improve in similar ratio, to sustain *double its present number.*

It is this spirit which should be emulated by all who are engaged in the cultivation of the soil. Let the *first effort* be not to enlarge the number of acres sown on a grain farm, or the number of cows milked on a dairy farm, but so to manage as to obtain the largest possible returns upon the old basis of operations, even if it should not be a still better way to reduce it somewhat at the beginning. When the produce, per acre or per cow, appears to have reached nearly the full capacity of the land or animals it is time enough to attempt more. This is what is meant in the often repeated remark that our farmers *have too much land;* not that there is any objection to a large farm, *if well farmed,* but that the proportion of the land is too great for the capital employed upon it. Nothing is ever gained by an endeavor to cultivate a larger surface than can be well manured, well tilled, and well harvested, or to crowd too many animals, whether dairy or grazing stock, upon pastures where the grass is suffered to be eaten bare and the land is yearly *skinned* of its plant-supporting ingredients, without the addition of anything to aid in meeting these constant draughts.

SELECT BREEDS OF CATTLE, AND THEIR ADAPTATION TO THE UNITED STATES.

BY FRANCIS M. ROTCH.

Agriculturists and political economists, in considering the resources and capabilities of our vast country, are apt to regard chiefly its *bread*-producing capacity, and to overlook its almost equally important and intimately connected ability to furnish *meat.* Impressed by our immense crops of grain, and with the seemingly exhaustless powers of the virgin soil, they look but at the numerical result in bushels of a single harvest, and do not take into consideration the number of acres required to grow the crop, and the consequent small yield per acre. It is the great amount of land under cultivation, the ease with which it is worked, and the sparse population, which affords such large crops, and enables so great a surplus to be exported. But this condition of things cannot last. The most fertile soil must in time become exhausted by constant cropping, and both the yield and the quality of the products deteriorate. In proof of this we may cite the State of Virginia, one of the most fertile of the earlier settled States. When the land was first cultivated abundant harvests of corn, wheat, and tobacco rewarded the most careless husbandry, and no doubt the first settlers regarded her virgin soil as inexhaustible. But the inevitable process of deterioration was silently going on, and at the present time thousands of acres of what was once the best land in the State have been abandoned altogether, or, if worked in the old method, furnish but a meagre return for the labor expended upon them. Even in our rich prairie States the same process is going on, for

the same causes are at work. An intelligent wheat-grower in Wisconsin writes to this department in 1851, "that lands that have been cultivated only twelve years in that newly-settled State now yield but half the number of bushels per acre which was obtained in the beginning." Extensive corn-growers in Indiana say "that river bottoms that once produced from sixty to eighty bushels of corn per acre now yield only from thirty to forty." Instances like these might be multiplied almost without end. Wherever the light of truthful and thorough statistics can be brought to bear on land under cultivation, there the diminution of its virgin fertility is demonstrated. The injury yearly to the country from this cause it would be difficult to compute. Dr. Lee, in an admirable article on the "Progress of Agriculture in the United States," communicated to this department in 1851, says: "Of the one hundred and twenty-five millions of acres now under cultivation in the United States, four-fifths, or one hundred millions, are damaged to the extent of three dollars an acre per annum!" Such are the lamentable results of the *American* method of cultivation, a method growing out of our having "a continent to cultivate and exhaust of its virgin fertility;" of our great facilities for internal communication; of our cheap land and dear labor. But we should remember that in time even a continent may become impoverished. We are trenching upon the best grain-growing districts with alarming rapidity. Annually the tide of emigration pours its floods over our unoccupied territory, till before long the wave of civilization from the east will meet that from the west at the base of the Rocky mountains, leaving no more land to be subjugated by the plough, no more valleys and hill-tops for fresh flocks and herds. Before this time arrives, then, it is the duty of those who look to the future of this country, who regard its greatest interests and its continued prosperity, and who would have it retain its proud position as the "granary of the world," to consider the great problem how best to save from injury and destruction the natural resources of the soil.

"To dig about and dung it," when we wish increased growth and vigor in tree or plant, is a maxim of Holy Writ, and gives us the clue to our grand problem of how to replenish the soil. Manure, as afforded by animals, is the great source of fertility and renovation, and its production depending upon the rearing, keeping, and feeding live stock, shows us the intimate connexion existing between the growing of bread and meat. By the help of the animal economy we are enabled to return to the soil in the state of plant food a large portion of those constituents taken from it by the process of vegetation. The close dependence of the animal and vegetable kingdoms upon each other, and the difficulty of successfully perfecting the one without the other, has been recognized by all enlightened agriculturists as one of the first principles of cultivation, and the foundation of all good farming.

Culley, an English writer upon "live stock" in the latter part of the last century, introduces his subject in the following words: "It has been a matter of surprise to many that none of our countrymen have hitherto attempted to write a treatise expressly upon what farmers call stock, by which are meant those domestic animals with which our fields, our yards, and stables are, or ought to be, stored, such as horses, neat cattle, sheep, and swine, the knowledge of which is, at this period of improvement, as necessary for the farmer as the proper cultivation of a field for wheat, barley, turnips, or any other crop. For, according to the present improved system of farming, there is such a connexion between the cultivation of the ground and breeding, rearing, and fattening cattle, sheep, and other domestic animals, that a man will make but an indifferent figure in rural affairs if he does not understand the latter as well as the former." The truth of these views found a ready assent among the farmers of England seventy-five years ago, and their practical application resulted in the enormously increased production of both grain and meat. Apart from the immense values involved in grazing and breeding, the vast grain-growing interests are deeply involved in

the production of the best varieties of live stock, and hence the greatly increased attention that should be given to this department of agriculture by every practical farmer, as well as the consideration it deserves from the statesman and economist.

Few, even of those directly engaged in the raising or feeding of live stock, confining the word in this connexion to cattle and sheep, are aware of the enormous value of this source of the farmer's wealth and the proportion it bears to the other products of the soil. From the census reports of 1850 we find that there were within our borders 18,355,387 of cattle and 21,620,482 of sheep! Supposing an increase of forty per cent. in the last ten years, we should now have the number of cattle as 25,697,541, which, at ten dollars per head, would give $256,975,410 as their value. Taking the same rate of increase for the sheep, they would number 30,268,674, and at one dollar and a half per head they would be worth $45,403,012, making a total value at these low figures of $301,378,422 for these two kinds of live stock!—a sum that compares well with the value of our justly-boasted wheat and Indian corn crops. In view, then, of this large amount of property invested in live stock in this country, we should make use of all the aids and means within our reach to improve their quality; and, by borrowing the experience as well as drawing from the herds and flocks of other countries, endeavor to adapt to our various localities and climates the best and most profitable breeds of domestic animals. Suppose that by judicious selections, an infusion of better breeds, and a more accurate knowledge of the principles and practice of breeding and feeding stock, we could add twenty per cent. to the annual profit of our animals in early maturity and in an increased product of milk, butter, or beef, (and as we shall presently see this proportion is within bounds and in accordance with actual results,) we should have an annual additional value equal to that derived from an increased capital of six hundred millions! In England such and even greater results have attended upon the application of science and improved management to the live stock of that country. Cattle-breeding has become a science; and when such men as Bakewell, the brothers Collings, the Earl of Leicester, Bates, Quartly, Tomkins, Booth, and Webb, in England; D'Aubenton, Cugnot, and Speck on the continent, and many others whose names are equally identified with the amelioration of their favorite breeds of cattle or sheep, devoted themselves to this branch of agricultural knowledge, we need no longer wonder that it soon assumed the dignity of a science, or that the ends attained were worthy the talents, energy, time, and money expended upon it. For more than a century have such minds labored to accomplish the results which are now proudly pointed to, in the matchless herds and flocks whose fame is spread over the whole world.

As a proof of the great improvement of live stock made in Great Britain under these influences, we extract the following facts from the valuable work on British cattle published in 1834 by the "Society for the Diffusion of Useful Knowledge."

In the year 1710 the average weight of beef cattle at Smithfield was 370 pounds each. In a report of a select committee of the House of Commons in 1795 it is stated that since 1732 their cattle have increased in size or weight on an average one-quarter or twenty-five per cent., making the weight at that time (1795) 462 pounds. Few animals then were fatted, even to this light weight, under five years old, while thirty years later they were considered ripe at four years. At this last period we find a very striking improvement in the weight of cattle at Smithfield, 656 pounds being the average—an increase of nearly forty per cent. in thirty-five years; showing that the efforts for the improvement of the breeds of cattle were attended with far greater success than at first. We have no later statistics of the Smithfield market by us, but we have no doubt they show a constantly-increasing weight combined with a still earlier maturity. It must be remembered, in considering these figures, that a

large number of Highland cattle, or "Scots," as they are termed, are sold in that market, whose weights, rarely exceeding 350 or 400 pounds, would much reduce the average. The superior quality and flavor of the beef from these little animals always assures a ready sale for them at the top of the market, and it is no unusual thing to see one of these little shaggy-coated Scots outsell a coarse Lincolnshire beast of twice his size. The peculiar state of the times during the period mentioned in Great Britain, as well as on the continent, had excited increased interest in agricultural pursuits; war prices and short crops stimulated production by the sure spur of large profits. The great question of how to feed the ever-increasing population was attracting the attention of some of the best minds of the age towards an improved system of farming, and all tended to foster and spread abroad through the land the impetus derived from a few leading spirits.

Having thus in a few words endeavored to show the universal importance of that department of agriculture pertaining to live stock, and also to point out the great improvement it is susceptible of when once public attention is fairly awakened, we pass on to a brief consideration of the different localities in the United States fitted for the raising or feeding of live stock, and of the geographical and climatic peculiarities which render discrimination in the choice of the breeds best suited to them indispensable. A glance at the map shows us the great extent of territory and consequent variety of climate and products embraced within our boundaries. Extending through twenty-four degrees of latitude and fifty-six degrees of longitude, including nearly the whole temperate zone, it stretches from the genial shores of the Pacific to the stormy coast of the Atlantic; from the pine forests of Maine to the orange groves of Florida. Within our borders are mountains of every elevation and character, from the sterile snow-covered peaks of the Rocky mountains, frequented only by the mountain goat, to the lower ranges of the Alleghanies, the White mountains and Green mountains, where the hardier races of cattle and sheep may one day be pastured as they now are in Switzerland. We have broad prairies and fertile savannas, rich intervales and sweet-herbaged hill-sides, as well as sandy plains, bare, stony ridges, parched wastes of coarse and scanty grass, and bleak northern pastures, all or nearly all fitted to support animal life, and yet each requiring for its most profitable occupation a race of cattle or sheep especially suited to it. The climate presents as infinite a variety as the face of the country. From the rigors of a Lake-Superior winter to the perpetual summer of the tropics, we have every gradation of temperature, and consequently every kind of vegetable products suited for the food of animals. We have only to discriminate in our selection and location of the animals we wish to introduce to attain successful results; but without this discrimination, and without a knowledge of the characteristics of the animal as well as of the circumstances that are to surround him, we shall incur disappointment and loss in any attempt we may make. A recent writer upon breeding (Goodale) says upon this point: "A due consideration of the natural effects of climate and food is a point worthy of the especial attention of the stock husbandman. If the breeds employed be well adapted to the situation, and the capacity of the soil is such as to feed them fully, profit may safely be calculated upon. Animals are to be looked upon as machines for converting herbage into money; now it costs a certain amount to keep up the motive power of any machine, and also to make good the wear and tear incident to its working; and in the case of animals, it is only so much as is digested and assimilated, *in addition to the amount thus required*, which is converted into meat, milk, or wool; so that the greater the proportion which the latter bears to the former, the greater will be the *profit* to be realized from keeping them." The impolicy of transplanting animals without a careful consideration of their former surroundings and habits as adapted to the new locality is, therefore, evident. Animals, to be sure, are comparatively easily acclimated,

and their organization conforms readily to circumstances. They will vary as regards size, constitution, and maturity, towards the fitting type of the locality, with this distinction, that when selections are made from too large or two delicate races they will deteriorate, whilst if made from smaller and inferior ones the tendency is to improve and enlarge.

For instance: suppose we take two young short-horns as nearly alike as possible. We know the characteristics of this race are size, early maturity, a propensity to fatten, and a quiet temper. Place one of these animals on the rich blue grass pastures of Kentucky or the fertile bottoms of the Ohio, he will grow and spread and luxuriate in his ample feed and easily-gained livelihood; he will lie down and grow fat; he will mature even earlier and reach a greater size, perhaps, than on his native Yorkshire wilds, and will prove himself the fitting type for his new home. Place the other animal upon the granite hills of New Hampshire, or on the arid plains of Texas, and the result will be widely different. Want of the succulent grasses and luxuriant abundance of food he is accustomed to will affect his growth; the increased labor in collecting enough of the scanty herbage to satisfy his appetite will wear upon him; his form will alter; his capacious frame will never be filled out; he will become flat-sided, light-carcassed, with a larger proportion of offal. His very temper will be changed; *habit* will induce activity and restlessness, and with them he will lose much of his fatting propensity—a quiet disposition being all-important to kindly feeding. Bring these two animals together after some years, and we shall scarcely recognize them as of the same race. Each has adapted itself, in a measure, to the requirements and capacity of its locality; the one has improved upon, the other degenerated from, the original race.

The following instance of this variation produced by change of locality came within our own knowledge a few years since. A young Ayrshire cow, a first prize at one of the local shows in Scotland, was sent as a present by a resident of the county of Ayr to a friend in the south of England. She was, of course, highly prized, and on her arrival was turned into the freshest of pastures and fed in the most liberal manner. This was new diet to an animal brought up on the "moor edge," and she soon began to thrive and lay on flesh, much to her new owner's pride and admiration; but at the same time her flow of milk diminished, and she became dry sooner than was expected. Once dry, she laid on flesh very fast, looking like a miniature short-horn; but the next season she milked very poorly, keeping her flesh and soon going dry, and never afterwards gave but a small portion of milk, retaining her condition till she was disposed of to the butcher.

M. Roulin, a few years since, communicated some curious facts to the Academy of Sciences at Paris regarding the changes which our domestic animals undergo when transported into warmer regions, which it may not be inappropriate in this connexion to mention. He says, the hog, in the warm valleys of South America, wandering in the woods and subsisting upon wild fruits, becomes ferocious and assumes almost the character of the wild boar. In St. Domingo and New Granada the cow undergoes material change. It no longer furnishes the supply of milk which we obtain from it in Europe, for when the calf ceases to suck it immediately dries up. The sheep introduced by the Spaniards into South America, in the temperate regions, have multiplied abundantly, without showing any tendency to submit to the domination of man. In the burning climate of the plains, on the contrary, they do not propagate freely, and a curious phenomenon is there witnessed: the wool of the lambs grows at first as in more temperate climates, but rather slowly; when in a fit state for shearing there is nothing remarkable about its quality, and when removed it grows again as in more temperate latitudes. But if the period for shearing be allowed to go by, the wool becomes thick, (?) falls off in patches, and leaves underneath not a new growth of wool, or a naked place, as if from disease, but

a short, shining, and close hair, exactly like that of the goat in the same clime; and where this hair once appears there is never any return to wool. Hence it appears sufficiently evident that these causes—*climate*, *food*, and *habit*—are powerful enough to alter the whole character of an animal not suited to them; and we may also infer that, in conjunction with domestication, they have produced the different varieties of domestic animals each from one original type, though to identify this type would carry us beyond the records of history or of tradition. But it is far more reasonable to suppose that these powerful agents have produced the diversities we see than to resort to the opinion that such varieties have been originally found as adapted to the spots where they have been placed.

Before proceeding further to describe these varieties so well adapted to widely differing localities and climates, we will first define what a pure breed is, and the distinction between a *breed* and a *race*. Goodale says: "By breeds are understood such varieties as were originally produced by a cross or mixture, like the Leicester sheep for example, and subsequently established by selecting for breeding purposes only the best specimens, and rejecting all others. In process of time deviations become less frequent, and greater uniformity is secured. But there remains a tendency greater or less, in proportion to the time which elapses and the skill employed in selection, to resolve itself back into its original elements, breeding back toward one or the other of the kinds of which it was at first composed. Races are varieties moulded to their peculiar type by *natural* causes, with no interference of man, no intermixture of other varieties, and have continued substantially the same for a period beyond which the memory and knowledge of man does not reach. Such are the North Devon cattle."

In this country we have no indigenous distinct breeds of either cattle or sheep. When this continent was discovered the only animal of the bovine race was the bison, or, as it is commonly called, the buffalo, now confined to the regions beyond the Mississippi river, but once a denizen of the whole country, to the very shores of the Atlantic, and the musk ox, an animal not found within the borders of the United States, but an inhabitant of the northwestern portion of the continent. What are called *natives* are a heterogeneous mixture of various breeds introduced at various times and for different purposes, and left to cross and mingle as chance or convenience dictated. In the earlier settlement of the country cattle and sheep were procured at different times from the continent of Europe, from England, and from the Spanish West Indies, with no view, however, to introducing them as breeds or to ameliorate the animals already in the country, but solely to supply present wants of labor and food. Beyond this, no purpose governed their selection, and no principles of breeding guided their crossing and propagation. From this mass of mongrel blood and ill-assorted races sprung our so-called natives. The first cattle brought into the country are said to have been introduced by Columbus. The Spaniards afterwards brought over others, from whence, no doubt, sprung the wild cattle of Texas and California. About the year 1553 the Portuguese took cattle to Newfoundland, of which, however, no traces now remain; and in 1600 Norman cattle were brought into Canada. In 1611 Sir Thomas Gates brought from Devonshire and Hertfordshire 100 head of cattle into Jamestown, and thirteen years later Thomas Winslow imported a bull and three heifers into Massachusetts. From this time more frequent importations were made, though still with little regard to their adaptation to the localities or to their effect upon the existing stock of the country, and the same promiscuous course of propagating them, (breeding it cannot be called,) combined with the hard fare and exposure they were subjected to in those early days, resulted in a race deteriorated from the original stock. Even now, if we examine a herd of natives, we can see oftentimes traces of the breeds from which they sprang, so prone is a chance medley of blood to breed back to its original elements. Having no fixed type to perpetuate, and no efforts having

been made to counteract this tendency, as where breeds are sought to be established by a regular course of breeding the various ill-assorted or antagonistic strains of blood break out, lending their peculiar characters to the produce. Here we see a cross of polled Sussex or Galloway cropping out; there the black and white Dutch evidently had a share in the parentage. This animal plainly goes back to his yellow Danish ancestor. In that one we see traces of the massive frame and docile temper of the short-horn, while in others the active step and characteristic color of the Devon is readily distinguished. But in a vast majority no fixed type is discernible, so inextricably involved has been their breeding.

The *natives*, though possessing some desirable qualities, are generally faulty in form, slow in reaching maturity, poor handlers, and heavy boned. They possess the one desirable trait of hardiness, and the cows are tolerable for the dairy. The working oxen are usually good, but slow, hard feeders, producing an inferior quality of beef. The steers are sometimes turned off at three and three and a half years old, but owing to their late maturity they are scarcely fit for the butcher, and make poor beef, rarely averaging 500 pounds of profitable meat. Full grown oxen, six years old and upward, do not average 800 pounds, even after several months stall-feeding on hay, roots, and meal, and a tolerably fatted cow, as a rule, will not make over 450 pounds of beef. Owing to their origin the natives have no fixed hereditary traits, and even those possessing desirable characteristics cannot be relied upon as breeders, to produce progeny of a like excellence. "Instead of constancy there is continual variation and frequent breeding back, exhibiting the undesirable traits of inferior ancestors." Were a careful selection made and a determinate course of breeding adopted by a patient and skilful breeder, there is little doubt out of our *common* material a much improved breed might be originated, which, with judicious crossing with some one of the improved breeds, might obtain rank as a dairy animal. Among the natives are found many excellent milkers, but in giving them credit for this property we must remember from how very large a number these good ones have been selected, and that were we to take the average of the whole class we should hardly be able to accord them tolerable praise in this respect. Colonel Jaques, of Massachusetts, attempted something of the kind in 1820 by crossing a native cow, of great excellence as a milker, with the imported short-horn bull "Cœlebs," and continuing to cross him upon his own progeny until he succeeded in establishing a tribe of cattle possessing a certain similarity, which he called "Cream Pots," and which attained a degree of local reputation. They were red in color, of fair size, rather flat ribbed, without quality, the skin being too thin, and gave a large quantity of rich milk. These animals can hardly be said to have been a distinct breed, not having been bred long enough to prove their ability to reproduce with certainty their like. Since their owner's death we have not heard of them, and the presumption is that they have degenerated and lost their peculiar excellence as milkers, and have become merged in the cattle of the neighborhood.

A somewhat similar case in sheep breeding is recorded in the Philosophical Transactions, showing clearly how, by taking advantage of an accidental variation, a peculiarity is perpetuated. "In 1791 one of the ewes of a farmer of the name of Lethbright, living in Massachusetts, produced a lamb of very singular appearances; these were shortness of the limbs and length of body. The fore legs were crooked, as to give them the appearance of an elbow, hence the name Ancon, from Αγκων, was given to this kind of sheep. By the advice of his neighbors, he reserved this singular ram for breeding. The first year only two lambs were yeaned in his likeness; in the following years a number more distinguished by the same peculiarities were produced." One may well wonder why these deformed sheep were preserved with such care. We are informed it

was not as objects of curiosity, but in consequence of their being less liable to jump over fences, "as they could neither run nor jump like other sheep!" Probably these misshapen productions have disappeared before a more enlightened appreciation of, and better taste in, stock. Specimens, however, may yet be found of the "Otter" breed as they were commonly called, showing how long a taint of the kind will remain in the blood, and how unexpectedly it will show itself in after generations.

As agriculture in this country began to attract more attention and interest, the *native* breed of cattle was seen to be lamentably deficient in most of the requisites of a desirable race, and numerous attempts were made to improve them by importations of various popular breeds from the other side of the Atlantic. Within the last fifty years the amelioration of the cattle of the country has been marked, and most encouraging results have followed the introduction of animals of the improved breeds. And though, from the great extent of our country, the dissemination of foreign blood is necessarily slow, yet its traces are already plainly seen in the great cattle raising districts of the west, in the earlier maturity and better quality of the stock sent to our great eastern markets. California even has recognized the importance of improving her vast herds, and has sought both in the eastern States and in England for pure bred animals to cross upon the wild Mexican cattle. The increased value of the stock, when such crosses shall have been established, is hardly to be calculated.

England, as the stock nursery of the world, has been the chief source from which our improved animals have been drawn, and though the variety of breeds within her borders is very great, our importations have chiefly been confined to half a dozen of the most popular ones, making it unnecessary to describe or mention the others, which have but a local reputation, and are in no way adapted to our country. The breeds from which selections have been made are the short-horn, the Devon, the Hereford, the Ayrshire, the Galloway, and the Jersey. Kerrey cows have been imported into Massachusetts within the last year or two from Ireland. Holland has furnished some cattle, among which the Chenery herd, imported into Massachusetts, will long be remembered as having introduced the fatal pleuro-pneumonia among the cattle of that State. Hungary contributed, some years since, to the stock of the country a bull and cow, imported by R. L. Colt, of New Jersey, but they were regarded merely as curiosities. We shall now consider and give a short history of each of those breeds in the order in which they are named.

SHORT-HORNS.

This race, for its antiquity and permanence entitle it to be so considered, is, without a question, the most universally popular, and the most widely distributed of any of the known varieties of cattle. Not only has it established itself in almost every county of England, in spite of the various local breeds, but in Scotland and Ireland it is almost equally at home. On the continent of Europe it has fairly gained a foothold, notwithstanding strong national prejudices, whilst the lately developed continent of Australia has taken her share of those noble animals to occupy her vast feeding grounds. Some have gone to South Africa, and an occasional one to South America, the West Indies, and Mexico, besides the great numbers imported into the United States and Canada. In short, this favorite race is rapidly planting itself wherever there is any improvement in agriculture or the rearing of cattle encouraged or the English language spoken. And they must make their way wherever soil and climate are suitable, and the people are intelligent enough to appreciate their merits. In our own country the importations of this breed have been in the ratio of a hundred to one over that of any other, and its especial adaptation to the rich grazing districts of the west gives it a prominence above them all.

This prominence is destined to increase as the country grows older and its population becomes larger, requiring more economy and intelligence in the production of food to keep pace with the growing demand. More attention must necessarily be paid towards selecting that breed of cattle that will yield the earliest and largest return for the amount of food consumed. The further this question is examined, and the more thoroughly it is tested by experiment, the firmer will become the conviction that the short-horn is the most generally adapted to the beef-growing districts of the country, at least until we reach the southern latitudes. In consideration of these facts, then, we shall be justified in giving a more extended and minute history of this breed and its origin than would otherwise be called for.*

More than a century ago, when the English gentleman travelled on horseback, attended by two or three servants armed to the teeth, and the stout farmers rode fearfully homeward in groups from the market town, trembling lest their well-filled pockets should attract the attention of some one of the numerous highwaymen that infested every part of England; when all articles of merchandise were transported on pack-horses, except on the most frequented roads, and on these the huge lumbering wagon that carried goods and passengers was often seen stuck fast in a quagmire; when the "fast coach" between London and Edinburgh was ten days on the way; when the undrained and badly tilled land yielded but fifteen bushels of wheat to the acre, and the cattle of every color and character had little care or attention from the farmer, there existed on the banks of the river Tees, that divides Durham from Yorkshire, a breed of large, roomy, rather coarse cattle, in color not unlike their descendants, the short-horns, though the fashionable *roan* was not common, with good hair and tolerable "touch," known as the *Teeswater* breed. These cattle were especially famous for their milking properties, and were in great request for the dairy. At the same time, when not in milk, they manifested such an aptitude to take on flesh, and when slaughtered exhibited so much tallow, that they were deservedly popular with the grazier. The Teeswater was the earliest dairy breed of which we have any account, and their excellence for the pail was what first distinguished them. It was an inherent quality, which all their long after-course of breeding to produce beef has not eradicated, and which still strongly characterizes some families and tribes. This race, though from its name no doubt having its origin in the valley of the Tees, was spread more or less over the adjacent counties of Northumberland, Durham, and Lincoln. Its deserved reputation had begun to attract the attention of the best farmers of the district towards its improvement, and crosses even were brought from Holland to effect this end. How much earlier it had existed as a breed than the period we have named it would be difficult to determine. A celebrated breeder (the late Thomas Bates) says: "This tribe of short-horns"—referring to a particular family—"was in the possession of the ancestors of the present duke [of Northumberland] for two centuries, [A. D. 1640,] and Sir Hugh Smythson, grandfather of the present duke, kept up the celebrity of this tribe of cattle by paying great attention to their breeding. He used, a century ago, regularly to weigh his cattle and the food they ate, *so as to ascertain the improvement made in proportion to the food consumed.*" It must be remembered that this was before Mr. Bakewell began to be known as a successful breeder, and before he began to disseminate, in his

* The principal sources from which we have drawn our information are Lawrence's, Parkenson's, and Culley's treatises upon live stock, Baily's Survey of Durham, Rev. H. Berry's pamphlet on short-horns Wright's essay on the history of short-horns in the Journal of the Royal Agricultural Society, Youatt's work on British cattle, and Mr. L. F. Allen's elaborate and carefully written history of the short-horns in the introduction to the first volume of the American Herd Book. In addition to these are our own notes and recollections of conversations with many of the distinguished breeders of short-horns during several visits to that country within the last ten years.

journeys through England, the true principles of breeding, which made his name so famous throughout the country. Some account of this celebrated breeder may not be out of place here, although the short-horns were not the breed of cattle he turned his attention to, and the long-horns that he brought to such a pitch of perfection have utterly passed away.

Robert Bakewell was born at Dishley, in Leicestershire, in 1725, and probably about the year 1745 commenced the series of experiments in breeding which proved so favorable to the progress of British husbandry. He died at the age of seventy-eight, having devoted his whole life to the improvement of the science of agriculture, especially of that department relating to breeding. The principles upon which Bakewell went in producing his improved breed of cattle and sheep may be summed up in the following words: "Fine forms, small bones, and a true disposition to make fat readily." This we gather from the testimony of friends and cotemporaries, as he himself as far as possible shrouded his *own peculiar* course of breeding in great mystery—no doubt with a beneficial result pecuniarily. But it is to be regretted that so little is certainly known of the means and methods he used to produce such admirable results; the lesson loses half its value for want of explanations. But for this reticence on his part, perhaps, we should not be obliged to record the almost utter disappearance of his favorite breed of cattle within a period of fifty years. Youatt says, "The reader may hardly credit the assertion, but it is strictly true, that at the present moment [1833] there is not a single improved Leicester (long-horn) on the Dishley farm, and scarcely a half-horn, (a half-bred.) There are not a dozen Leicesters within a circuit of a dozen miles of Dishley!"

To be able to estimate the revolution effected by Bakewell we must recollect the erroneous conceptions at that time prevalent concerning stock. Breeds were comparatively unknown, or, at least, unpurchased beyond their original localities. False notions of excellence, varying in different places, were held generally by farmers. In Norfolk a ram was valued according to the number of turns in his horn and the blackness of his face and legs. In Wiltshire a white face and a horn curved behind the ear were indispensable. In Dorsetshire it was thought that the horn must project before the ear; while the South-down breeder held a speckled face and legs and no horns the grand desideratum! Large bones were universally esteemed the criterion of excellence, whilst the carcase was forgotten. Of course there were exceptions to this state of things, and the breeders in the valley of Tees seem to have had a truer conception of some of the principles of breeding than was to be found in other parts of the country. Against all this mass of prejudice and ignorance Bakewell had to contend, and but for the practical proof he was able to show at Dishley of the truth of his theories, he might have tried in vain to stem the torrent of error or to rouse the British farmer from his lethargy.

As early as the 17th century we find that the Aislabies, of Studley Park; Milbank, of Barningham; Sir William St. Quentin, of Scampston; Sir James Penryn, as well as others of less note in the north of England, turned their attention to the improvement of the Teeswaters, and with no mean success, as we shall presently see when giving the weights of some of the fat cattle of that breed, slaughtered towards the end of the 18th century. The sources from which these breeders drew their herds is somewhat obscure. Sir William St. Quentin is said to have obtained some of his from the Aislabies, who are represented to have had fine cattle for many years previously, and he is said to have crossed them with bulls imported from Holland, of a white color, and not, as Youatt supposes, with the Chillingham Park wild breed, whose white, brittle horns, black noses, dull, ferocious eye, and other characteristics totally unlike the short-horn, sufficiently refute the supposition. Mr. Allen tells us that he heard it asserted that the cattle from which Sir William St. Quentin made his importation were originally sent from England to Holland two centuries ago, as

a present from James II to William, Prince of Orange, then stadtholder, at the time of his marriage with his daughter. These cattle were originally pure white. The ancestors of Sir Edward Blackett, of Matfor, in Northumberland, then owners of Newby Hall, paid great attention to short-horned cattle at the same time as the Aislabies. Portraits of these animals were occasionally taken and hung up to adorn the entrance hall; but when the noble residence passed out of their hands the pictures were sold. As before mentioned, the dukes of Northumberland had for many years bred the Teeswater short-horns, and so fond was Sir Hugh Smythson of his cattle, that when raised to the peerage by George III his peers dubbed him the "Yorkshire grazier." The Earl Percy, who fought at Bunker Hill in the revolutionary war, was his son, and it was during his absence in America that the estate of Stanwix was grossly mismanaged, and its fine race of short-horns all sold off or fattened for the butcher!* Mr. Berry says: "Great antiquity is claimed for some of this stock in Northumberland, and as early as 1770 a Mr. Dickson, and probably some others, had cattle that were famous milkers, and much resembled in other particulars the short-horns of the present day, being quiet feeders and good handlers. We might enlarge upon this subject, and prove that the short-horns are of an ancient and superior race; and it is undeniable that wherever throughout Great Britain the good milking and quiet feeding qualities of any breed of cattle are sought to be improved, the short-horns are universally resorted to, and, when properly selected, always with marked success. We saw these crosses in infinite number on the cattle of Ireland, Scotland, England, and Jersey, and the colors and forms of the short-horns immediately stamped themselves upon the produce and predominated, which is proof indisputable, if other were wanting, of their great antiquity and long high breeding." Culley mentions "a Mr. Dobinson, of Durham, who was noted as having one of the best tribes of short-horned cattle," and says he early in life went to Holland and bought bulls there, and crossed them upon his herd with great success, though afterwards some other persons of less knowledge going over, brought home some bulls that in all probability introduced along that coast the disagreeable kind of cattle well known to the breeder adjoining the river Tees by the appellation of "*lyered*, or double lyered," that is, "black-fleshed." "However," the old chronicler adds, "by the pains and attention of breeders, this useless and disagreeable variety is now [1770] pretty well out of the country." There seems but little doubt that crosses were introduced from Holland for the purpose of improving the short-horns, and, as might be expected, with varying results, depending upon the knowledge and skill of the breeder. But it is doubtful if any permanent benefit was derived from them, or how extensively the cross was attempted.

As a proof of the degree of excellence attained by this breed of Teeswater short-horns, even at that early day, we quote from Berry some of their weights:

In 1779 an ox, bred by Mr. Hill, of Blackwell, slaughtered at six years old, weighed 171.10 stone, (2,124 pounds;) tallow, 11 stone, (154 pounds.)

Sir Henry Gray, of Howick, bred two oxen, which were fed by Mr. Waistell, and at six years old weighed 130 stone each, (1,820 pounds,) their proof (inside fat) being extraordinary.

In 1787 the Howick red ox, slaughtered at seven years old, weighed 152.9 stone, (2,137 pounds;) tallow, 16.7 stone, (231 pounds.)

In 1789 an ox, five years old, bred and fed by Mr. Milbank, of Barningham, weighed 150.4 stone, (2,104 pounds;) tallow, 16 stone, (224 pounds.)

A four-year old steer, bred by James Simson, of Aycliff, and fed by Mr. C. Colling, was slaughtered at Sunderland, having been fed on hay and turnips alone. His weight was 135 stone, (1,890 pounds.)

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* Allen's introduction to American Herd Book.

Two three-year old steers, bred by Miss Allen, of Grange, and fed on hay and grass alone, weighed 92 and 96 stone, (1,228 and 1,334 pounds.)

A heifer, three years old, by a grandson of the old Studley bull, bred by the same lady and fed in a similar manner to the steers just mentioned, weighed 90 stone, (1,260 pounds.)

A cow, of Mr. Hill's stock, slaughtered in Northumberland, weighed 127 stone, (1,778 pounds.)

Many more well authenticated instances are given by Mr. Berry. We have not given these weights as very extraordinary in themselves, as they have been far exceeded in the present day by animals of half the ages of those enumerated, but as proofs of the value and character of the Teeswater cattle of that day, the originals of the improved short-horns.

We have been thus particular in tracing the early history of the Teeswater short-horns in order to show that before the Collings and later breeders began to improve them the Milbanks and St. Quentins and Smythsons of a much earlier day had succeeded in establishing a good and valuable race, combining, in a degree, both milking and feeding properties, and only needing the science and energy of modern days, stimulated by the enhanced values of agricultural products, to become the valuable and popular breed we now find it. The energy and science needed at this period to continue the development of the short-horn was found in the brothers Robert and Charles Colling, whose names became from this time so identified with their favorite breed that we shall make no apology for giving a sketch of their lives, and of their operations as breeders. Robert, the elder, was born in 1750, and Charles in 1751. They both settled near Darlington, in Durham, Robert at Bampton, and Charles at Ketton, on a farm which his father gave up to him on his marriage, and on which he remained during his whole career as a breeder. Of the early life and advantages of the Collings we know very little; both accumulated property, and Charles retired at sixty years of age with an ample fortune, removing to Munkend, in the North Riding of Yorkshire, where he died in 1836, at the advanced age of eighty-five. Robert continued as a breeder some years after his brother's retirement, and only abandoned the pursuit two years before his death, which occurred in 1818. Though Charles Colling obtained the greatest reputation as a breeder, and at the sale of his herd realized higher prices, it is by no means clear that the elder brother was not the best breeder. He was a man of less pretension, less disposed to experiment, but of no less accurate judgment and quick perceptions; and the difference in the reputation gained by the two brothers may more likely be accounted for by the superior address, sagacity, and knowledge of mankind possessed by the younger brother, than from any actual superiority as a breeder. Charles is said, in the early part of his life, to have paid a visit to Dishley, and spent three weeks with Bakewell, and to have there imbibed his first ideas of breeding. On his return to Ketton, the manifest superiority of the short-horns as material for improvement over the stock Bakewell was experimenting with, no doubt struck him, and determined him upon the course which he so successfully and profitably followed for over thirty years.

The period at which the Collings began their career was especially favorable to the development of enterprise and the application of scientific knowledge to agriculture. England was highly prosperous, and though her arms were not successful abroad, the high war prices and the necessity of providing large home supplies fostered all improvements and stimulated to the utmost all classes of agriculturists. Added to this was the example of royalty itself. George the Third turned farmer and became a correspondent of Bakewell, then in the zenith of his fame. A host of distinguished names were soon enrolled under the banner of the "Farmer's Friend," and stamped the era as one of active advance in both the science and practice of agriculture. Charles Colling was too shrewd an observer not to take advantage of this movement, and having

discerned the merits of the short-horns as a foundation, he turned his whole energies to the task of making them the best breed in England. One of his early and important moves towards this end was the purchase of the bull *Hubback*. About the purity of the blood of this animal there has been some controversy, but it is now generally conceded that he was a true short-horn on his dam's as well as his sire's side. This celebrated bull Mr. Colling bought when a calf, in 1783, for eight guineas, of his brother and a Mr. Waistell, who had themselves bought him but a short time before, on account of his promising appearance, for the same sum, and why they so soon sold him is unexplained. Charles Colling was much pleased with his purchase, and as soon as he got him home sent to his wife "to come out and see the handsomest little bull she ever saw in her life." So highly did he esteem him that he never suffered his services to be used outside of his own herd. Unfortunately, his great feeding propensity early made him useless, but he left his impress upon the Ketton herd, laying the foundation of its future reputation. He is described as being smaller and more compact than most of the breed, "with clear, waxy horns, mild, bright eyes, and a very pleasing countenance; his handling was superior to any bull of his day; his coat was of soft, downy hair, and he had the habit of retaining it long in the spring before shedding."

The Collings at first adopted Bakewell's theory of close breeding, that is, of breeding from near affinities of blood, as sire and daughter, son and dam, brother and sister, and they carried this to several generations. In one instance, that of the cow "Clarissa," it was carried as far as the sixth cross, she having *sixty-three* sixty-fourths of the blood of her sire, Favorite. But cases of such extreme in-and-in breeding were rare, and probably only tried as an experiment. We think, however, that some of the ill effects of close breeding might have been discovered in the Ketton herd. "Comet," himself, the highest priced bull at Charles Colling's sale, (sold for a thousand guineas,) had a deformed shoulder, and this, it is well known, among cattle as in the human race, often proceeds from defective lungs, which are the frequent attendants, in common with delicacy of constitution, upon too close breeding. "Comet," too, it was notorious, got far better stock upon cows that were strangers to him in blood than on the higher bred ones of his own kin.

Charles Colling was too acute an observer not to perceive the dangers as well as the benefits of too close an adherence to this system of breeding, and he soon began to experiment with crosses of foreign blood, not always, perhaps, with the intention of infusing such strains into his herd as from a love of experiment and a confidence in his own powers and reputation as a breeder to use and mould the most heterogeneous materials. The Kyloe and the Scots, in turn, were tried and abandoned. Next the Galloway presented itself as a favorable tool to diminish the size, shorten the leg, and condense the carcass of the rather loosely built short-horn; its hardy habits would be decidedly useful, and the quality of the flesh and hair was such as to render the experiment still safer. Add to this that they could be found of a red color, and it must be confessed Colling had good reason to expect favorable results from the cross. To this breed, therefore, he resolved to resort, and at once proceeded to carry out his intentions, and thus introduced in his herd the "alloy" about which so much discussion has been had.

It may be instructive to shortly trace out the course of breeding which produced the cow "Lady," through whom the *alloy* was engrafted upon the stock. A polled Galloway heifer, belonging to a Mr. O'Callighan, was served by "Bolingbroke" (86) and produced a red and white bull-calf, called "O'Callighan's Son of Bolingbroke," which, when he was old enough, was put to an old short-horn cow, "Granna," nearly past breeding, and she, in 1791, produced a bull-calf, also red and white, known as "Grandson of Bolingbroke," (280.) This grandson was, when grown up, put to "Phœnix," one of Mr.

Colling's best cows, the mother of Comet's dam, and in whose veins coursed some of the best blood of the day. She produced, in due time, the heifer "Lady," in 1796, and from her are descended all the animals having the Galloway cross in them, as we do not find that either of the cross-bred bulls, son or grandson of Bolingbroke, were used, except in the one instance, and, indeed, it is said both were castrated soon after being thus used. "Lady" was bred to the best bulls in the herd, and her produce again to the same class of bulls, thus reducing the foreign strain of blood to the smallest proportions at once, which is the only method by which any cross of the sort can be introduced with success.

It is very questionable, however, whether any good was really effected by this erratic move of Charles Colling. We are disposed to think that "Lady" and her produce were good *in spite* rather than in consequence of the cross. She was but one-eighth Galloway and seven-eighths of excellent short-horn blood, which last was probably enough to overcome the influence of the foreign blood. At Charles Colling's sale "Lady" and her descendants sold for high prices, and were eagerly sought by various breeders. But it must be remembered that the renown of the Ketton herd was then at its height; the Collings were the *fashion*, and there were but few herds of improved, or we should rather say improving, short-horns at that time in England. Every breeder of any pretension sought to stamp his stock with the "*hall mark*" by getting one of these favorite animals, and there were but forty-seven to be sold. The animals were in the highest condition, and no doubt "Lady" and her progeny were as blooming as the rest. It is little to be wondered at, then, that all sold at high prices, especially as many of the "alloy" females were got by the very best bulls, and in calf to others that were to be soon scattered over the country and monopolized by individual herds. Of the seven alloy cows five were stinted to the 1,000-guinea "Comet," then pronounced the best bull in the world. Notwithstanding these facts, we observe that the highest priced animals at the sale were quite pure from the "alloy;" showing that at the time the Galloway cross was not considered to have been essential to the creation or perfection of the improved short-horn! So much for the famous "alloy," which for the last fifty years has been a bone of contention among short-horn breeders, and the discussion of which has so magnified its proportions that many persons now believe Colling made the improved breed by crossing with the Galloway. How much practical effect it may have upon those animals of the present day possessing this blood we will not discuss; merely observing that an animal descended in the most direct line from "Lady" would, in the 12th generation, have but one part of the alloy blood in 8,192, or, in other words, would have 8,191 parts of short-horn blood to 1 part of Galloway—an infinitesimal drop, to say the least. Such crosses have, it is more than suspected, been taken with beneficial results by those seeking to improve certain breeds of cattle and sheep; but extreme caution and watchfulness are needed, and even then in after generations the foreign blood will crop out, reproducing some undesirable character of the stranger race. Thus we have seen a loose lop-horn, on an animal possessing only the minute proportion of "alloy" above mentioned, imputed to the ancient cross of the polled Galloway.

As the most important sale of improved short-horns that had up to that time taken place, and one that long remained unparalleled in the annals of the race, we will add a summary of Charles Colling's sale. Forty-seven animals—consisting of seventeen cows, eleven bulls, seven bull-calves, seven heifers, and five heifer-calves—sold for £6,073 4*s.*; being an average of nearly £130, or $650 each! A brief account of the appearance of this celebrated stock, as given by Mr. Wright, in the Royal Agricultural Society's Journal, may not inappropriately close our account of the Ketton herd. He says: "They were of great size and substance, with fine long hind-quarters; the space from the hip

to the rib was long, but the evils attendant upon an extreme length in this part were counteracted by a broad back and high round ribs; the shoulders of the males were upright, and the knuckles or shoulder-points were large and coarse, but that defect was not so apparent in the females; the general contour or side view was stately and imposing, but their great superiority consisted in extraordinary inclination to fatten. On handling, the skin was very loose and pliant, and the feel under it was remarkably mellow and kind. Mr. C. Colling was distinguished above all other breeders of his day by a peculiarly fine, discriminating touch, which enabled him to judge of the quality of the flesh and its tendency to fatten; to which, in connexion with good judgment in other respects, his superiority and success as a breeder were mainly attributable. The color of the Ketton short-horn varied greatly—red, red and white, roan, and also white, being found in the same kindred, and in all crosses of close affinity there was a great tendency to white."

The career of Robert Colling as a breeder not being so completely identified with the short horn, nor so successful pecuniarily, may be passed over without further comment, except to observe that the lower prices obtained at *his* sale were owing to the less inflated state of the produce market and to the somewhat diminished interest in agriculture in consequence of the great political agitations, rather than from any inferiority in his stock. By many of his cotemporaries he was considered the better breeder, though never exerting the influence or acquiring the reputation of his younger brother.

Before taking leave of the brothers Colling we must not omit to notice the far-famed "Durham ox," bred by C. Colling, that first attracted the attention of the general public to the superiority of the short-horn by being exhibited all over the island as a prodigy of size and flesh. We give the Rev. H. Berry's account of this once celebrated beast: "The Durham ox was got by Mr. C. Colling's bull 'Favorite,' the sire of 'Comet,' and was calved in the year 1796. His form and quantity of flesh indicated that propensity to fatten for which he was afterwards so much distinguished. At five years old he was not only covered with fat at the principal points, but his whole carcass was in a manner loaded with it, and he was deemed so wonderful an animal that he was purchased to be exhibited as a show by Mr. Bulmer, of Harmby, near Bedale, in February, 1801, for £140, ($700.) At that time (five years old) he was thought to weigh 168 stone, (2,352 pounds,) his live weight being 216 stone, (3,024 pounds;) and this extraordinary weight did not arise from his superior size, but from the excessive ripeness of his points." He was sold on the 14th of May following to Mr. Day for £250, ($1,250,) who, on the 8th of July next, could have sold him for £2,000, ($10,000.) Of course, this value was predicated upon his popularity as a *show*. He was travelled about the country for exhibition till he was eleven years old, when he dislocated a hip, and after two months of painful illness was slaughtered. His greatest recorded live weight was at ten years old, when he weighed nearly 3,400 pounds! His carcass weighed as follows:

Four quarters, 165 stone 12 pounds	2,322	pounds.
Tallow, 11 stone 2 pounds	156	"
Hide, 10 stone 2 pounds	142	"
	2,620	"

Since the days of the Collings the improvement of the short-horn has gone steadily on; but it will not be necessary to follow the gradual, but sure steps by which such men as Bates, the Booths, Earl Spencer, Lord Ducie, Townley Douglas, Torr, Fawkes, Sir C. Knightly Combe, and a host more well-known breeders, have succeeded in bringing them up to their present point of excellence,

a point far in advance, as regards style, flesh, and early maturity, of the famed Ketton herd. There are those who contend little or no improvement has really been made since the time of the Colling brothers! But could one of the large, coarse shouldered, red and white short-horns of those days be led into the ring of the R. A. S. and placed side by side with the winners of to-day, we think even the most bigoted adherent of the "good old times" must acknowledge the improvement in finish and beauty, as well as in substance and quality. We were once told by a breeder who had seen "Comet" "that he would be considered only a second rate bull at the present day!" We may also adduce in support of our position the continued high prices obtained, notwithstanding the greatly increased numbers of short-horns. At the sale of Lord Ducie's herd in 1853 sixty-two animals sold for £9,361 16*s.*, being over £152 per head, nearly £20 more per head than C. Colling's herd brought.

In one respect, however, we must confess the old short-horns completely bore away the palm from their descendants. We refer to the milking property, once the distinguishing characteristic of the race. The breeders of the present day have voluntarily sacrificed this valuable quality for the sake of acquiring an earlier maturity and a greater propensity to fatten. Beef! beef! has been the cry from one end of the kingdom to the other as its large population became denser and food must be found for them. Butter and cheese, and milk even, were luxuries compared with *meat*, and, therefore, the production of the greatest amount of meat in the shortest possible time, and with the least consumption of food, became the short-horn breeder's great aim. So far have they carried this, in common, we must add, with the breeders of almost all the other improved races that this constitutional and valuable quality of the original short-horn has in many cases been almost destroyed, though it is so strongly inherent that there are tribes and families that yet retain it in an eminent degree. We ourselves are of the opinion that it need not have been so utterly neglected as it has been, believing that in this breed the two properties of feeding and milking are marvellously united. Such was the opinion of that eminent breeder, Mr. Bates, who insisted strongly upon this view, and in his favorite and high bred Duchess tribe jealously retained the property. He says in a communication to the Farmers' Magazine: "Finding that tribe of cattle (the Duchess) were equally extraordinary as great milkers induced me afterwards to purchase my first Duchess, then in calf to 'Favorite,' and her daughter, and afterwards, at the sale in 1810, the granddaughter. My first Duchess calved at Hatton Castle, in Northumberland, June 7, 1807. She was kept on grass only, in a pasture with nineteen other cows, and made in butter and milk for some months above two guineas per week.* As a proof that this tribe of short-horns have improved under my care, I may mention that 'Duke of Northumberland's' dam consumes one-third less food than my first Duchess, purchased in 1804, and her milk yields one-third more butter for each quart of milk; and while the consumption of food is one-third less, and the milk yields one-third more butter, there is also a greater growth of carcass and an increased aptitude to fatten." The original Teeswater possessed this strong milking property, with a considerable propensity to to take on flesh; and it was the combination of these two qualities that made early short-horns such favorites with the dairymen and milkmen; and to this day all the large milk establishments for the supply of London use this breed and its crosses. They find that after they are dry they get a much better price for them from the feeder or butcher, on account of the ease with which they are fed, than they can for cows of any other breed, while

* We regret Mr. Bates did not give weights and quantities rather than values. But his remoteness from any city and the comparative want of facilities of internal communication must have kept the price of such articles low, and we may, therefore, reasonably conclude the yield to have been large.

no other breed will at the same time yield so well over the pail. It was this peculiarity, the conjunction of these two often-supposed incompatible qualities, that induced Mr. Whitaker, a large cotton manufacturer of Burley, in Yorkshire, with a large number of hands to supply with milk, to attend Charles Colling's sale, and to purchase there, as well as of other breeders, and to lay the foundation of a herd whose extraordinary performances over the pail earned them a wide-spread reputation. Mr. Berry has recorded a few facts regarding this herd which we here copy: "Yellow Rose at three years old gave 36 quarts (wine measure) of milk per day, and at four years old gave 38 quarts. Red Daisy gave 32 quarts per day. Wildair and Magdalena gave the same quantity. Western Lady gave 28 quarts." Many others are mentioned by name, and Mr. Berry remarks: "These cows are steady milkers, possessing great inclination to fatten, and Mr. Whitaker cannot be too highly complimented on his successful exertions to combine the two qualities." John Hare Powell, of Pennsylvania, who imported from Mr. Whitaker's herd, has given in "Hints to American Husbandmen" the yield of his cow "Belina," showing that change of locality, climate and food made no difference in this characteristic of the short-horn. In May, 1827, Belina, on pasture at Powelton, fed with Indian meal slop, in addition to the grass, gave 26 quarts of milk per day, from which the milk for three days churned and yielded at the rate of 20½ pounds of butter per week! This fact is thoroughly attested by certificates of respectable persons. With this decided inclination of the short-horn to unite the milking and feeding properties, we cannot but regret more care has not been bestowed on retaining the two combined. This is especially to be regretted as regards the value of the breed in portions of our own country where the dairy is an important branch of agriculture. It would be well for the breeder living in a dairy district to select his strains of blood with reference to this ancient trait, many families yet retaining it in an eminent degree.

The short-horn breeders of the present day in England are, with but few exceptions, divided into two parties. Ranged under the banners of the Booths and Bates, the adherents of these two celebrated breeders are constantly pitted against each other in the friendly rivalry of the show yard and sales ring, and are equally strenuous in advocating the merits of their respective favorites. So far both claim the victory. Taking, however, the public sales as a criterion, the Bates blood has made the highest prices, and where the two have been brought in direct competition in the show yard it is difficult to decide which have oftenest borne away the palm. Both are descended from the Collings stock, the Bates from Duchess, and the Booth through Suwarrow, Pilot, and Albion. This sort of rivalry between breeders is often carried so far as to be productive of real harm to their herds. Jealousy and dislike prevents their making use of each other's bulls, and confines them to their own strains of blood, thus inducing them to breed from too close affinities, and engendering an almost certain deterioration of the stock. Without going into the merits of the two strains of blood, we may safely say that the Booth blood has produced many extraordinary females, whilst the Bates blood has furnished the most celebrated bulls. In this, as in all else, we are inclined to believe with the old proverb, "*in medio tutissimus ibis*," and to predict that the man who shall skilfully combine both these warring elements will achieve the greatest triumph. Colonel Townley has in a measure done this, both strains of blood being represented in his herd, together with the admirable strain from "Barmpton Rose," by "Thickhock," and his flattering success at the royal and provincial shows would support our opinion. Mr. Thorne's herd, on this side of the Atlantic, has also representatives of both the great English factions, and though the size of his herd enables them to be kept distinct, yet we look for great results from their judicious crossing.

We now take leave of the Old World, and glance hastily at the importations of short-horns into the United States. The earliest introduction of this breed

of which we have any authentic account was in 1783, when a few animals were brought into Virginia, and from there carried into Kentucky some years after. We mention this importation not as having any important bearing upon the cattle now existing in that State, as it is probable no pure blood descendants from these animals remained, but as being the first step in an improved agriculture that was to revolutionize our large cattle-growing districts. In the early part of the present century a few small importations were made at various times, but so little importance was attached to *blood* and so little attention paid to pedigrees that few records were kept, and much doubt and obscurity attends any researches respecting them. New England, New York, and Pennsylvania were, up to the year 1834, the chief localities benefited by these importations, the earlier of which were scarcely appreciated, and the animals were sadly deteriorated through want of care and knowledge in their treatment and breeding. In 1834 the Ohio Stock Breeders' Association was formed, and introduced a number of fine animals into the lately developed west, where their admirable adaptation to the climate and country had made them long before deservedly popular, and where, at the present day, with their crosses they form the greater portion of the cattle grown and fed. Importations have been frequently made since then into all parts of the Union, which it is not necessary to particularize. Among them, however, as of especial prominence, may be mentioned those of R. A. Alexander, esq., of Kentucky, Messrs. Morris and Becar and Samuel Thorne, of New York. The last-named gentleman, having united the herds of Messrs. Morris and Becar with his own, has become the most prominent breeder of short-horns in the United States. His herd, although not so numerous as many, surpasses all in the high character of its individual animals, and in the perfection to which they are grown. With much to contend against in change of climate and food, Mr. Thorne has successfully rivalled the best breeders of the Old World, and has the honor and credit of being the first man to send back to England short-horns bred on this side of the Atlantic. To those who know the tenacious pride and strong prejudices of our cousins across the water, and who remember the length of time that they have stood at the head of agricultural improvement in this department, and have been the source from which all the world has drawn its supplies of high-bred animals, the magnitude of this triumph will be evident. In 1860, seven years from his first importation, Mr. Thorne sent to England five young bulls and a heifer, all of his own breeding. They were most of them engaged beforehand by eminent breeders, and it is gratifying to know that none were disappointed in the animals, and that they obtained the highest encomiums from the best judges and breeders. We confidently predict that this will be but the forerunner of further exportations of stock, and cannot but congratulate the country on the possession of so spirited and successful a breeder as he who initiated this movement.

Having closed this somewhat particular history of the short-horns, the length of which we trust the importance of the theme warrants, we will now briefly describe their appearance and leading characteristics in their present improved form. The majestic size, proud carriage, and beautifully variegated colors of the short-horn render him easily recognized by the merest tyro; but few who thus admire and recognize them are aware how many qualifications go to make up this splendid whole, or how carefully each point has been weighed and discussed, and its relative value decided; how the useful parts are divided from the ornamental and fashionable, and how systematically the whole has been carried out. The "high caste" short-horn should have a small head, a broad, flat forehead, with no projection of the frontal bones; the face should be well cut out below the eyes, tapering to a fine muzzle with open nostrils; the nose must be flesh or chocolate colored; any discoloration hinting towards black or blue is very objectionable, though occasionally seen in some of the highest bred families; the eye must be bright, prominent, and yet placid; a small piggish

eye, or one showing viciousness or nervousness, are alike to be avoided, the latter indicating a bad feeder almost invariably; the horn should be well set on, curving forward, not too heavy, and of a waxy, yellow color at the base; the body should be square, massive, and symmetrical, set on short legs, which should be straight and well under the animal; the fore legs should be small in the bone below the knee, whilst the forearm must be broad and tapering downwards, fitting level into the girth; the hind legs must be nearly straight; if the hocks are too much bent, turned inward, or not well under the body, it not only gives an awkward gait in walking, but is generally a sign of weakness; the neck is moderately long, clean in the throat, and running neatly into the shoulders, which should not be too prominent at the points, nor too wide at the top, else the crops will be certain to seem defective; they should mould nicely into the fore-quarters, and be well covered with flesh on the outside; the neck vein should be well filled up with flesh, and form on smoothly to the shoulder points; the chest must be broad and deep, and full back of the elbows, which secures a good girth and consequent room for the most important vital organs; the brisket should be full and broad rather than narrow and projecting; it is of inferior quality as beef, yet, as a point of beauty and as indicating a propensity to fatten, must not be overlooked. We now come to the upper portion of the frame, carrying the best beef, and here we must have width and thickness and length; the crops must fill up level with the shoulders and back; the ribs must spring level and full from the back, and fill well up to the hips, (the short-horn is apt to be loosely ribbed up.) The loin must be broad and well carried forward into the crops, and covered with thick flesh moulding nicely on to the hips, which though wide must not be too prominent, but slope away gradually to the rump or "*side*" bones at the tail; a quarter badly filled up between hips and rumps or "scooped out," as it is termed, is very objectionable; the back must be level from neck to tail, with no drops back of the shoulders, nor any rise where the tail is set on; the rumps must be well laid up but not too high, else when the animal is fat we shall have those large masses of fat aggregated about them so common among the breed some years since, but now deservedly stigmatized as bad; the twist should be well filled out in the "seam," wide and deep, the outside thigh full, the flank deep, and forming with the fore-flank and belly (the latter well supported by its plates) a parallel line with the animal's back. The whole frame must be evenly covered with flesh, of a mellow elastic nature, readily yielding to the fingers, yet following them as the pressure is withdrawn; the skin must be of a moderate thickness, neither "*papery*" (too thin) nor thick enough to be stiff and hard; it must be covered with a coat of thick, soft, mossy hair. As regards color the latitude is very great, from deep blood-red through all the intermediate shades and mixtures to pure white, but any other colors, as brown, black, or dun, are never met with in thoroughbreds. Fashion has vindicated the rich red and purple roan as the most desirable colors, and after them red. White is sometimes objected to, under the impression that it is apt to spread through a herd and overpower the other colors; but this fear is more common in this country than in England, where white bulls are often used. Red and white, in blotches, with defined edges not running into roan, is disliked, and the term "patchy" is applied to it. This discrimination, however, as regards color, is entirely arbitrary, animals of equal excellence and breeding being found of all these colors.

We may gather from the foregoing pages that the essential peculiarities of the improved short-horns are, early maturity, a great disposition to fatten, a remarkable evenness in laying on their flesh, a gentle, quiet temper, and, in some tribes and families, a large secretion of milk. It has been claimed by some of their more zealous advocates in this country that they make good oxen, but we hardly think, however docile and powerful they may be, that they can compete in activity and speed with some of the other breeds. Taking into con-

sideration these characteristics, we see how admirably adapted they are for the larger portion of our country. Wherever there is fair pasturage, good water, and shelter from the extremes of heat and cold, there the short-horn thrives. Over the broad prairies and blue grass pastures of the west, in the rich valleys of our great rivers, he roams and flourishes as though in his native vale, and readily adapts himself to the change of situation and climate. But it is to the crosses of the short-horn that we must look for the most general adaptation and dissemination of the breed. The high value of the thorough-breds for breeding purposes must for many years prevent their universal adoption, and it is only by crossing them upon our so-called natives that we can reap immediate benefit from them. Fortunately for us, no breed more promptly and strongly stamps its impress upon other blood than this one. All the writers on cattle unite in this opinion, and some even advocate crossing the short-horn or other pure races, with a view to their improvement. We shall usually find, however, the most remarkable and satisfactory results when the short-horn is put upon a mongrel or a lately established breed, as then the deep breeding of the sire will obliterate the numerous thin strains of the dam's blood, and the produce will resemble the superior race. The cross between the native cow and the short-horn bull almost always produces good milkers, and, as a whole, they afford more milk of a better quality than any other breed, and, when dry, they feed quickly and make excellent beef. In this connexion we extract from the Fifth Annual Report of the Massachusetts Board of Agriculture a portion of a statement made to them of the dairy performance of some grades of short-horns belonging to Mr. Robinson, of Barre. The cows were half and three-quarter breds. Seven of them yielded, during the first seven days in June, 2,207$\frac{7}{8}$ pounds of milk, averaging 45 pounds per diem to each cow. From this milk 232 pounds of cheese was made, averaging one pound of cheese to nine and a half pounds of milk. The same cows gave during the three following days 955 pounds of milk, from which 41 pounds 9 ounces of butter was made, averaging one pound of butter to twenty-three pounds of milk. It will be seen that the milk that makes one pound of butter will make two and a half pounds of cheese. These cows had no extra feed during the trial, having been turned to pasture on the 15th of May. This instance is selected not as a very extraordinary performance, but as a well-authenticated and carefully-conducted experiment. We may, without fear of contradiction, pronounce the females of the cross of the short-horn and native as essentially and almost uniformly deep milkers. The original strong predisposition to milk that marked the race, which is shared by none of the other pure races, is admirably fitted to combine with the occasional and accidental quality in the native and in the progeny to assure pre-eminence on this point. The steers are thrifty, and lay on flesh rapidly and evenly, and are ready to turn off at two and a half or three years old. They are hardy as their *native* parent, and bear transportation and driving admirably, shrinking less than the thorough-breds. The greater proportion of the cattle now brought from Ohio, Indiana, and Illinois, and from even further west, to supply the New York and Philadelphia markets, are crosses of this character, and none pay the feeder so well, whilst the butcher is rarely disappointed in the fifth quarter.

Numerous experiments have been tried in England in crossing the short-horns, with various results, but generally with advantage to the race upon which the short-horn has been put. Even with the Devons the result has been satisfactory; though this is somewhat at variance with our preconceived notions of breeding, which do not lead us to expect much where two such opposite and distinctly marked races, both of great antiquity, are brought together. We give below an instance taken from a communication of Charles H. Bolton to the British Farmer's Magazine. After describing a heifer of this cross that had just been fed and slaughtered, he says: "I have seen many excellent beasts bred from improved short-horns and long-horned cows. Indeed, I never knew any

one of these bulls put to any cow where the produce was not superior to the dam. But the cross which I advocate and with which I am best acquainted is that with the Devon cow. I have uniformly remarked that each succeeding cross was attended with a proportionate improvement in size, quality of flesh, [?] and aptitude to fatten. In every instance they have shown themselves *superior milkers*, and stand to the pail till within six or eight weeks of calving, and several instances have come to my knowledge where they have never been dry since they first calved. And so highly are they prized as milkers, that a friend of mine who hired out dairies informed me that the dairy-men gave him nearly £2 [$10] per cow per year more for the half and three-quarter breds than they would give for cows of any other breed. A friend of mine had about a dozen North Devon cows, small in size but nice in quality, and from them he commenced, about twenty years since, breeding with short-horn bulls. With each succeeding cross the stock rapidly improved in every essential, and the only trace of the Devons that I could perceive when I last saw them, about two years since, was a peculiar richness in their coloring. All his stock are superior milkers. Here we have twenty years' experiment and continued improvement." In these instances the milking property was sure to be developed: the Devons being always known as giving very rich milk, though in small quantity, whilst the short-horns gave large quantities, but of somewhat poorer quality; combining the two could not but improve the character of the produce as a dairy cow.

It is not necessary to particularize the various other crosses of the short-horn, in all of which the characteristics of the breeds combined are generally to some extent *mingled*, the progeny partaking of the character of both parents, though it oftener preponderated on the side of the high-bred short-horn. As an exception to this rule, and as an instance of the difficulties encountered by the experimentalist in breeding and of the caution necessary in deducing theories from isolated cases, we will mention the cross with the Jerseys, or Alderneys, as they are generally called. In this case we have brought together two ancient races, possessing characteristics widely differing, and long bred for opposite purposes, the one for beef, the other for milk. On the one side the square, massy short-horn, with his wide hips, flat back, broad loin, and deep chest, and general aspect of flesh and substance; and on the other the Jersey, delicate in frame, with long, slender limbs, deer-like head, narrow chest, large belly, and thin skin. No two breeds could be more entirely antagonistic; and, consequently, we find them scarcely amalgamating, but inclining to the one side or the other, in accordance with some law yet unknown to us. In the first instance within our knowledge the produce of this cross was to all appearances a short-horn, with scarcely a trace of the diminutive Jersey; head, frame, constitution, size, all seemed taken from the larger race; even the peculiar color of the Jersey was barely discernible in the yellowish red of the progeny. In another instance of the same cross the result was diametrically opposite, an animal being produced very like the Jersey dam, except in increased size and the superior proportional breadth of the pelvis and hips. The color was in this case also a yellow red and white. The milking property was admirably developed, the quantity being much increased, whilst the quality was but slightly impaired. This animal's progeny by a Jersey bull could with difficulty be distinguished from a thorough-bred Jersey! These are the only instances within our knowledge where the two pure breeds have been crossed, and the opposite results are certainly instructive. They evidently arise from the too wide distinction between the races, each of which possessed such strong inherent characteristics as to prevent their mingling, and some unknown cause produced the entire preponderance on the one side or the other which we have observed. A further cross on the side to which the produce bore the most resemblance would, as we have seen in one of the cases mentioned, be very apt to quite obliterate any traces of the fainter blood.

Here we may take leave of the celebrated short-horns, having traced them from their infancy in the narrow vale of the Tees up to the present time, when their representatives are found in nearly every civilized country on the globe. Judging from their rapid growth in importance and popularity, we may safely predict for them a still greater preponderance over every other breed. The rich grazing grounds of the western States, the vast plains of California, and the boundless pastures of Australia are destined at no very distant day to become the homes of the short-horns and their grades, and with this change will come a greatly increased production of food for man and a better remuneration to the stock-grower.

So much importance has long been attached to the descent and genealogy of this high-bred race that a herd book, or authentic register of the breed from their earliest existence, or at least from the date of the earliest registers kept by the first importers of the breed, was started in 1822, by Mr. George Coates, in England, and has been continued by his successor in the enterprise, Mr. Henry Strafford, up to the present time. It now numbers fourteen large octavo volumes, and records the pedigrees of 19,176 bulls, together with a much larger number of cows and their produce. America, France, and Austria, have now their own "herd books," founded on the English or parent one, to which most of the pedigrees refer in their original descent. Our own now numbers five volumes, and is published at short intervals as the constantly increasing herds seem to demand.

DEVONS.

Next to the short-horns the Devon race of cattle has been more largely introduced into the United States than any other breed, and though in many respects a contrast to the former race they are deservedly popular, and suited to localities and circumstances the larger breed are unadapted to. No race in England can claim such undisputed antiquity. For more than two hundred years have the red cattle of Devonshire been known as a breed of distinguished beauty, hardihood, and admirable fitness for the yoke. But little pains had been taken to improve the breed till within the last seventy-five years, when the general revival in agriculture throughout Great Britain, and the impetus especially given to the growing of live stock by Bakewell and his followers, roused the Devon breeder from his apathy and showed him he had something to do, amid the general struggle for excellence in the various breeds of cattle, to preserve the ancient reputation of his favorites. Though possessing, without doubt, the best material, it had been allowed to lie idle, and it was rather in spite of their supineness than in consequence of their efforts that they found the Devons still existing as a breed among them. The nature of the soil and the climate, assisted by the natural tenacity of the native stock, conduced to the preservation of the breed. Vancouver, in his report of the farming of Devonshire in 1808, mentions them as "an important breed of animals, active at work, and their aptitude to fatten unrivalled." He further adds that even then they were declining in their general standard of excellence and numbers, "from the great demand which has been made for these cattle from other parts of England, where the purchasers (Mr. Coke and others) spare neither pains nor price to obtain those of the highest proof and beauty." The breeders and feeders from other districts were, even at this time, more awake to the merits of the breed than were the farmers of Devonshire themselves. But the late Mr. Francis Quartly, of Molland, perceiving this drain of their best cattle and its consequences, exerted himself to check it by himself purchasing the best animals he could find and stimulating others to do the same. He soon became known as a prominent breeder, and his successful and patriotic exertions are made honorable mention of in Acland's Report of the Farming of West Somersetshire. By a long course of selection and by an intimate knowledge of the

then unrecorded and unrecognized strains of blood in the different herds, and by a skilful combining of the various elements he was enabled to attain to perfection the great object of the Devon breeder, the lessening of those parts of the animal frame which are the least useful to man, as the bone and offal, and at the same time the increase of such other parts, as fat and flesh, as furnish food, and to do this at the earliest possible age of the animal and with the least consumption of food. Mr. Quartly succeeded in fully establishing these characteristics of the breed, and no greater proof of his success and the reputation of his stock need be adduced than the fact that nine-tenths of the pedigrees of the present herds of these beautiful animals in Davy's Devon Herd Book go directly back to the old Quartly stock. Of 29 prize bulls mentioned in this book 27 are descended from the bull "Forester," and of 34 prize cows, also named there, 29 are descended from the old cow "Curly," both of which, bull and cow, are from the Quartly tribe of Devons. "Hundred Guinea," another noted bull of this tribe, is as boasted an ancestor in the pedigrees of this breed as "Hulback" among the short-horns. The Davys, for several generations, have been zealous and successful breeders in North Devon. Mr. G. Turner, of Barton, Exeter, is also a celebrated breeder in South Devon, and his name often appears in the prize sheets of the Royal Agricultural Society. Mr. Mogridge, of Molland, has also been a successful breeder from the stock of the Quartlys. The Devon is not confined to his native county, but finds adherents in all parts of the country, among the most celebrated of whom may be mentioned the late Earl of Leicester, who introduced them at Holkam, the Duke of Bedford, who bred them for a long while at Woburn Abbey, though they at length gave way there to the Herefords, and Mr. Hudson, of Castle Acre, who prefers them to all other breeds, and annually feeds many steers.

Though indigenous to a county possessing the mildest climate in Great Britain, this breed is remarkably hardy and vigorous, and thrives where larger or more delicate animals would scarcely live. This may, perhaps, be accounted for by the general mould and character of the breed, from their compactness of frame and large vitality and lightness of offal, which, at the same time, gives them quickness of movement and a lightness of step, combined with great endurance. For labor no other breed in the world can excel the Devon ox, and in the earlier days of agricultural improvement it was this peculiar excellence which went far to give them their value. Throughout Devonshire, until very lately, most of the labor of the farm was performed by oxen, though the increasing demand for bulls has prevented for some time past the best herds from furnishing steers for either the yoke or the shambles. Youatt tells us that "where the ground is not too heavy the Devonshire ox is unrivalled at the plough. They have great quickness of action, that no other breed can equal and which very few horses excel. They have also a degree of docility and goodness of temper, and a stoutness and honesty of work to which many teams of horses cannot pretend. Vancouver, in his Survey of Devonshire, says that it is a common day's work on fallow land for four steers to plough two acres with a double-furrow plough. Four good Devonshire steers will do as much work in the field or on the road as any three horses, and in as quick and often quicker time, although many farmers calculate two oxen to be equal to one horse. The principal objection to the Devon ox is that they have not sufficient strength for tenacious, clayey soils. (?) They will, however, exert their strength to the utmost, and stand many a dead pull which few horses could be induced or forced to attempt." Their activity is such that at harvest time or in catching weather they can be trotted with the empty wagon at the rate of six miles an hour, a speed that no other ox could possibly attain or stand.

For the production of beef of superior quality they are unsurpassed, even rivalling the little Highland Scot in the estimation of the London west-end

butcher, whose fastidious customers oblige him to kill none but beef of the finest quality and flavor, and who may, therefore, be considered a good judge of excellence in this particular. The Devon does not, indeed, attain the great weight of some breeds, but their advocates claim that on a given quantity of food, and in a given time, they will make as much beef as any of them. The flesh is of high character, being well marbled and mottled with fat and of fine grain. The weight of meat is laid on the choicest parts, the shoulder, side and fore-flank being well covered with flesh; and, in addition, they have a peculiar property of furnishing meat of first-rate quality along their tops or backs. A well-bred Devon, in good condition, will always show flesh over the very back bone itself, thus, of necessity, securing a good thickness over the loin. It is this admirable distribution of flesh that distinguishes the Devon. We rarely meet lumpy, patchy beasts; they invariably feed evenly, or level, as it is called, and their proof (inside fat) is excellent. The Devon comes early to maturity, and is ripe for the butcher by two or two and a half years old; having small frames and light bone, they rapidly attain their growth and lay on flesh at once. The common weight for a cow is from 950 to 1,100 pounds, live weight. The ox reaches 1,500 or 1,600 pounds, being much larger than the bull. This last, though a heavy is rarely a large animal, being close to the ground, with a very round rib, giving him an appearance of even less size to a casual observer than he really possesses. The ox can be fed to 2,000 pounds without difficulty. We are here speaking of the best bred animals. Multitudes of red cattle are called Devons, with little pretension, except color, to the name. And we may observe here that there are two classes of Devons even in Devonshire—the North and the South Devons. We have spoken only of the former as being the true improved Devon. The South Devon is a larger, coarser animal, with less activity and hardihood and a greater tendency to milk. Some writers have endeavored to establish the fact of these last being a separate and distinct breed; but there is little doubt they are but an off-shoot of the true Devon, modified by situation, care, and breeding. In speaking of the race, therefore, we always refer to the North Devon as its true type.

Devonshire has long been noted as one of the dairy counties of England, and "Devonshire clouted cream" is considered as a luxury wherever it is known, quantities of it being sent to London for the tables of the rich. We should naturally expect to find the native breed of cows especially suited, then, to dairy purposes. But this is not the case; though giving a moderate quantity and an excellent quality of milk, the Devons are excelled at the pail by some other breeds. There are those, we know, who claim that the deficiency in quantity is more than compensated by the superior quality, and who prove their belief by selecting Devons for the dairy; but the general opinion and belief is that they are fitter for the yoke and the shambles than for the pail. As a general thing, in their own county the cross breds or grades are usually preferred to the full breds for the dairy. The dairies are generally small, the average not exceeding ten or fifteen cows. It is a common practice to keep a Jersey cow among the number, to give character and appearance to the butter, though the color of the Devonshire cream is almost always rich. The cows hold their milk a long while, are liable to few diseases of the udder, and are small consumers, and, like all well-bred animals, fatten readily when no longer in milk. A Devonshire dairyman tells us "that upon an average ten cows give me sixty pounds of butter a week in the summer and twenty-four pounds in the winter. A good North Devon cow fattens two calves a year." Other authorities place the general average of the Devonshire dairies as high as one pound of butter per day from each cow during the summer months. As before observed, the South Devon is a much better animal over the pail; instances are recorded of cows of this breed yielding two pounds of butter per day soon after calving. Some tribes and families are far better milkers than others, which, of course,

arises from the neglect or sacrifice, on the part of the breeders, of this quality to earlier maturity and a greater propensity to take on flesh; but while we should hardly claim for the Devon the character of a dairy breed, at the same time we should be unjustified in condemning it as such. When crossed with our native stock the quality of the milk is improved, whilst its quantity suffers little diminution, and we know of several dairies in which this cross is preferred to all others.

Before leaving this part of our subject it may not be without interest and advantage to describe the process of making the famous Devonshire "*clouted cream*" to which we have alluded, especially as it is claimed that by the method employed in making it the yield and quality of butter is improved, milk thus treated yielding one quarter more butter. The milk, immediately it is drawn from the cow, is strained into shallow pans, in each of which about half a pint of water has been previously put, and in the winter the same quantity of boiling water is used. The water is employed to prevent the milk sticking to the pan, by which it would be burned, and thereby rendered useless for the manufacture of cream. It now remains undisturbed in the dairy from twelve to twenty-four hours, according to the state of the weather. Thus in *sultry* weather the morning's milk is scalded in the evening, whereas, under ordinary circumstances, it would be retained until the following morning, and done with the previous evening's milk. The process of "scalding" is performed by various means, generally over a small charcoal furnace, occasionally on a clear wood fire, or by a warm water bath. By the first plan the pans are placed on the iron plate which covers the flue of the furnace, and moved slowly towards the fire so as *gradually* to increase the heat of the milk. This usually takes from forty to fifty minutes, and too much haste is a frequent cause of failure with persons unaccustomed to the practice. The period for removing the pan from the fire is indicated by the appearance of small bubbles under the "head" (or layer) of cream, giving the surface a dimpled appearance. It takes place at the temperature of 180° Fahrenheit, which is several degrees below the boiling point, to which if the heat should rise the cream formed on the top is broken, and the milk is spoiled for this purpose. When the milk is removed it is replaced in the dairy, and care taken to preserve the surface of cream unbroken. It is skimmed from twelve to thirty-six hours after, and the cream either sold in its present state (that sent to London is put up in earthenware jars holding about a pint) or made into butter.

The use of a water bath for this operation of "scalding" is by far the *safest* and quickest mode of procedure. A flat boiler, made of sheet iron, (two feet wide, seven feet long, and one foot in depth,) is fixed over a large flue or arch, in which wood is burnt. A quantity of *cold* water is placed in the boiler, and three pans of milk, supported by rings resting on the edge of the boiler, are placed in it. As the water becomes heated the milk in the pans increases in temperature with it, thus raising the temperature of the milk far more gradually than could be effected by the most careful movement of the pan towards the fire. Another advantage resulting from this method is *greater expedition*, which is very important in the summer months, as butter made from cream *slowly* formed will not keep as well as that made with a shorter exposure of heat. The extent of surface in the milk pans produces a large "head" of cream, but *the depth of the milk* in the pans and *the firmness of the cream* increase in the same proportion. Six or eight quarts of milk is the quantity operated upon in each pan, but in some dairies twelve quarts are used. In general, eight quarts of milk will yield one pint of "scald or clouted cream." The butter is quickly made from this cream by working the cream in a small tub by means of a stick, and is superior in every respect to *raw cream* butter. In those dairies where much butter is sold in firkins they generally make it with equal quantities of raw and scald cream, being the most productive, obtained with the least ex-

pense, but inferior in quality. By this process of "scalding" milk the butter is so completely removed that the milk which remains is very poor.

Various experiments have at different times been made upon the feeding properties of the Devons in comparison with other improved breeds, and with varying results, but generally they have proved themselves rapid and, from the superior quality of their beef, profitable feeders. In a trial with Devons and Herefords made by the Duke of Bedford, the former, though in poorer flesh and costing less in the month of April when turned to grass, by the end of December were superior in fatness and weight. In a more exact and careful experiment made by the same nobleman, in 1797, he selected and fed six oxen (two Herefords, two Devons, and two of other breeds) for a year, weighing all the food consumed, and the result was in favor of the Devons; though the smallest and lightest cattle when put up, they gained the most in weight. These instances, though of course not conclusive, still agree with our opinion of the ready feeding property and general thrift of this breed. It has been said that Devons do not transplant so well to the *corn farms* of other parts of England, where a *larger* class of animals are wanted to consume the coarse grains and root crops, and that *their* especial mission is to convert *grass* into beef, and therefore they are better fitted for their own district. But they are nevertheless found all over England, though it must be confessed they have by no means been so generally adopted as the short-horns.

The earliest importation of Devons into the United States, of which we can find any authentic record, was that of Mr. Robert Patterson, of Maryland, to whom Mr. Coke, afterwards Earl of Leicester, and an ardent admirer of the Devons, sent six heifers and the bull "Taurus." Mr. Patterson divided the heifers between his father-in-law, Mr. Caton, and his father, the bull being owned in common, and from these animals are descended the present herd of Mr. Patterson and that stock now so widely disseminated through the country. They are larger than the improved Devons of the present day, darker in color, and very good milkers. The dam of "Taurus" made thirteen pounds of butter per week. Of late years the importations of Messrs. Wainwright, Van Rensselaer, and Faile, of New York, of Mr. McHenry, of Maryland, and of the Massachusetts Board of Agriculture, as well as numerous others, have introduced some of the finest specimens of this breed into the United States. In Connecticut we find a number of herds of the earlier style of Devon, chiefly descended from the Patterson importation, and the well-known excellence and reputation of the oxen of that State is no doubt owing to the strong infusion of this blood that prevails throughout it. The Devon readily accommodates himself to his new home and its surroundings, and the beautiful herd at "The Meadows," on the banks of the Hudson, seem as much at home with the thermometer 20° below zero as on the damp, breezy downs of their own land. Their easy acclimation to the more extreme seasons on this side of the Atlantic proves the inherent vigor and constitution of the breed, and adaptation to the rougher portions of our own country, where the Devon may perform his peculiar mission of converting the scanty produce of cold and high pastures into meat—a mission which he executes in so profitable a manner that the larger breeds can never hope to rival him in it. The Devon has been aptly termed the "pony of the ox tribe."

We will now try in a few words to describe the North Devon, as we have seen him in the show yard of the Royal Agricultural Society, the admired of all beholders, where even "short-horn" men confessed him a model of perfection. He has a small, lean head, a somewhat dishing face, a delicate, light-colored nose, a bright, prominent eye, surrounded by an orange-colored ring, small, flexible ear, elegantly symmetrical horns, which have an upward tendency and are slightly turned out at the tips, a light neck, round, full bosom, and a deep chest, with a good, full fore-flank; the shoulder sloping, without a coarse point, and rising slightly above the line of the back, forming with the crest a sloping line

from the head, which adds much to the style and carriage; the crops are full, with no hollow or drop behind the shoulder, and moulding nicely into the full, springing rib, which, with the last-mentioned point, (the crops,) especially marks the well-bred Devon; the loin is broad, the hips wide but not "ragged," and the quarter long and well filled up between the hip and rumps: these last should be well up, but here we find the point most liable to weakness in the whole form—they are frequently low, narrow, and joined with a crooked leg; but in our perfect specimen the rumps lie well up and are well covered with flesh; the bone is fine, and the cord of the tail long and slender, finishing with a full tassel of white hair. Our Devon is of a rich blood-red, with a tinge of golden light playing over his soft rippled coat; but the color varies from a decidedly yellow-red to a mahogany color, though this last, when accompanied with a dark nose and almost black color about the head, is a very questionable hue for a true North Devon. The "quality" of the Devon is more generally good, perhaps, than in any other breed, and in the best bred animals may be taken as nearly perfection; and, as indicating excellent and rapid feeding properties, it is one of the most important points to be observed. In view of its importance in all breeds of cattle, and of its especial excellence in the one we are describing, we shall enlarge upon it a little here, trying to describe in words what it is difficult to explain without the aid of the hand on the animal.

Quality, *touch*, and *handling* are synonymous terms applied to the character of the skin and its adjacent tissues as ascertained by feeling. An animal having this property in perfection should possess a mellow hide, moderately thick, yet loose and yielding to the fingers when gently raised, and resuming its place with an elastic spring, as if there was underneath a tissue of wool impregnated with oil. This property is termed "*resilience*," and depends upon the organization beneath the skin, and the presence or absence of cellular or fatty tissue. The existence of this tissue constitutes a good handler, its deficiency the reverse. Physiologically speaking, a mellow skin arises from a free circulation of the vascular system (blood vessels) through the meshwork of cellular or adipose (fatty) tissue, or those cells that are destined for the reception of fat. These tissues are always in a moist state, from the internal cavity of the cell performing the office of exhalation. The adipose and reticular tissues are pervaded with small blood-vessels, more especially that portion in immediate connexion with and lying under the skin. A good and mellow handler has a full development of these tissues well spread over the superfices of the external frame between it and the skin. This membraneous tissue is a bed for the organs of the absorbents, and the adipose tissue is the storehouse in which the fat is deposited by the exhalents peculiar to it. These membranes participate in the character of the hide, they are more dense and inelastic, and less expansive. They do not admit of being so readily dilated by the deposit in their interstices, and consequently are longer in acquiring a mature state in the progress of making fat. A very thick, unyielding hide, not conforming to the internal deposit in the adipose tissue beneath the skin, is thus continually reacting by pressure on the absorbents, and in this manner makes the animal slow in accumulating fat on the external parts of the frame. A thin or "papery" hide, on the other hand, yielding readily to the touch, easily lifted from the subjacent tissues, and feeling like a fold of pliable leather between the fingers, indicates a want of cellular and adipose tissue, and consequently the deposit of fat will be meagre. It is important to make the distinction between a *mellow* and a *thin, loose* skin; there must be a certain amount of substance and resistance under the hand to mark the happy mean, and without this the animal will not make superior beef. It should be observed here that condition, of course, makes a difference in the handling or touch of the same animal. As the cells of the tissues become filled with fat they become firmer, and afford more resistance to pressure, whilst the hide becomes proportionably tighter, so that an animal nearly ripe seems almost hard to the touch,

but there is still a certain elasticity and mellowness scarcely to be described that assures the judge that *good* meat is beneath his hand almost as certainly as though he saw it upon the butcher's block. In connexion with "handling" we may observe that the hair should be thick and mossy, glossy and soft, with a yellowish exudation at their roots, and in proportion as this exists as a quality or constituent so is the propensity to make fat. On the other hand, a thinness of hair and a coarseness of fibre denotes an unthrifty animal, more especially if conjoined with a dense, unyielding hide and short hair. This implies a bad handler, and is a sure indication of being a slow feeder, with a tardy disposition to increase in volume of either fat or muscle. It is by the *feel* of the cutaneous tissue that a judgment is formed as to the state of maturity now, and of the condition and worth hereafter. The difference in the feel between the glossy and the coarse-haired animal is dependent on the secretion from the skin. In the thick skin it is inspissated, (gummy,) and exfoliates in branny scales. In the mellow, glossy skin it is more oleaginous, giving the skin that peculiar unctuous feel that is so fair an index that that organ is performing its healthy functions. We can thus understand why a knowledge of "*handling*" is so necessary to the breeder and feeder, as well as to the butcher, and why so much stress is laid upon it, as a sure indication of the animal's power and propensity to accumulate fat readily, and how the skin exerts so important an influence in developing the disposition to fatten.

The Devon has been crossed with various other breeds, and from his ancient strain of blood and strong *individuality*, if we may be allowed the term, generally imparts to the produce of such crosses much of his own character. This is especially remarked in regard to the color, which is almost certain to be that of the Devon. Even in the case cited above, of the herd of Devons crossed for several generations with short-horn bulls, the richness of color was the strongest remaining feature of the original race. Youatt mentions crosses with the Hereford and Jersey, the former with improvement in size but with loss of activity; but neither have been considered desirable enough to pursue. When our *natives* are crossed with the Devon the produce strongly resembles the pure race, and many steers of great beauty and value are bred in this way, their uniformity of color and horn enabling them to be easily matched. They inherit so much of the character and activity of the Devon, with somewhat increased size, that they make, perhaps, the most generally useful oxen in the country. The peculiar excellence of the Devon and their crosses for the yoke especially recommend them to a great portion of our country where oxen are used for the labor of the farm. In the lumber districts of Maine, and in the "pineries" of the west, their hardihood, endurance, and activity, combined with all the other good qualities of the ox, would render them most desirable, and were they once introduced we are confident none others would be employed. It is claimed that they endure the excessive heat of our southern climate better than any other breed, and the fine herd of Mr. Peters, of Atalanta, Georgia, unfortunately carried off by pleuro-pneumonia a year or two since, seemed good evidence of their adaptation to the warmer latitudes of the Union.

As the Devons increased in popularity and value the necessity of some authentic record of pedigrees was felt, and Mr. Davy, himself a breeder, established the Devon Herd Book in 1851. It has reached three volumes, and is to be issued from time to time as the wants of breeders demand. An American reprint has been published by Mr. Howard, of Boston, the third volume of which is entirely devoted to animals owned or bred in this country.

HEREFORDS.

This is another of the aboriginal races of British cattle, and evidently, at some remote period, sprung from the same stock as the Devon. In the earlier

existence of this breed the characteristic white face, by which they are now so generally recognized, was not a peculiar mark of the Hereford. They were formerly of all shades of red, brown, or brindled, and it is only within the last seventy or eighty years that this marked feature in color has been bred in. Within this period important improvement has been made in the general form and character of the race by systematic selection and skilful breeding. Various accounts are given as to how the white face was first introduced. Mr. Andrew Knight states that the first specimens of the white-faced breed were brought from abroad, some cows of that color having been introduced into the country by a Lord Scudamore, and this supposition seems to be strengthened by the variety having only become numerous in the last century. Another account makes it purely accidental. The favorite cow of a breeder at Huntingdon, in Holmer, produced a bull calf with a white face, which, from its singularity, was preserved and reared as a curiosity, and the progeny of this bull became celebrated for white faces. Another account still traces the new color to the early Welsh cattle, the most esteemed of which were *white with red ears*, and supposes the white-faced to have originated from these. Gisborne speaks of having seen herds of tawny cattle with white faces from the Ukraine that would have puzzled a Herefordshire grazier to have distinguished from coarse specimens of his own native county. But, however introduced, the white faces have become an established mark of the breed, and few herds with any pretensions to reputation are otherwise colored. The white extends along the throat, the under part of the body, the inside of the legs, and to the tip of the tail, the rest of the body being a deep, rich red.

As early as 1766, Professor Lowe informs us, Benjamin Tomkins, of Wellington Court, Herefordshire, commenced breeding with two cows which evinced a singular propensity to fatten; one of the cows, a gray, the other a dark red, with a spotted face. The former he called "Pigeon," the latter "Mottle." The produce of these two cows was separately bred, and from them are descended the two tribes known even at the present day by their names. Before Mr. Tomkins, the earliest breeders of whom anything is known were Tully, Yeoman, Skyrene, and others, whose herds embraced the various colors then fashionable. There were three distinct varieties at this time—the dark gray, the light gray, and the mottled face, all equally well bred; but so carefully have they since been bred with regard to color, that though the best herds claim near relationship with *all* these strains of blood, few now present any but the appearance which characterizes the modern true-bred Hereford. Mr. Tomkins bred up a large herd from the two cows above named, and his stock was eagerly sought for by the best breeders of the day, as Price, Hewer, Hayton, Knight, Smithers, and others. At the sale of his stock in 1819, shortly after his death, the prices obtained at public auction fully supported the high estimate placed upon his herd by the breeders of Herefordshire. Fifty-two animals, including twenty-two steers, from calves to two-year olds, and two heifer calves, brought the sum of £4,693 14*s.*, averaging £89 17*s.* 6*d.* ($445) per head! A bull, sold to Lord Talbot, brought £588, ($2,870.) These prices have rarely, if ever, been exceeded in later days. Mr. Price followed in the footsteps of Tomkins, having drawn his herd from the latter; but he paid so exclusive attention to the form and feeding property as to entirely sacrifice the milking quality, never very marked, of his herd. A few years since, the Herefords were little known out of their own county; now they form the principal breed of the counties of Monmouth, Radnor, Brecon, Salop, and parts of the counties of Gloucester, Warwick, Stafford, Wilts, Herts, Dorset, Somerset, and Cornwall. There are also some good herds in North Wales and Scotland, for which districts their hardihood renders them peculiarly fitted. The late Lord Berwick had one of the finest herds of this breed, and no one could see them without remarking their great uniformity of breeding, their thrift and substance, their thick, mellow

hides, covered with soft, long, wavy hair, and their rich color, rendering them beautiful objects in the noble park through which they roamed. Lord Berwick was a noted prize taker at the Royal Agricultural Society's shows, and the high reputation thereby attained by his herd brought him buyers from abroad, the chief part of his sales having been to France, America, and Australia. It is unnecessary to mention other numerous herds and their breeders with which that part of England abounds, as they are scarcely known beyond their own neighborhoods, though often of great excellence.

The importations of Herefords into this country have been comparatively few. The first we have record of was by the late Henry Clay, of Kentucky, in 1817. It consisted of two bulls and two heifers, costing in England for the lot £105. The breeder's name is not given, but the price would indicate that they were not from a herd of large reputation. Admiral Coffin, in 1824, presented to the Massachusetts Society for the Promotion of Agriculture a bull and cow bred by Sir J. S. Cottrel. The cow never bred; the bull lived to a good old age, and was the sire of a progeny generally esteemed in that part of the State where he was kept. The most important importation of Herefords was made in 1840 by Messrs. Corning and Latham, of Albany, New York, consisting of five bulls and seventeen cows and heifers. The herd was afterwards increased by other importations, and has since been divided between the above-named gentlemen, who have each made later importations. In 1852 Mr. Dowley, of Boston, imported a bull and two heifers bred by the late Lord Berwick, and other small importations have from time to time been made. Some of this breed have found their way into Ohio. Mr. John Humphrey, of Elyria, Ohio, exhibited at the New York State Society's show in 1858 some admirable specimens of the breed, proving that, though able to endure privations and hardships, the rich pastures and abounding cornfields of the west were amply appreciated by them. The universal popularity of the short-horn has, however, interfered with their spread in that direction.

We cannot better describe a well-bred Hereford than by giving the words of a writer in the Royal Agricultural Society's Journal, who says: "The face, mane, throat, the under portion of the body, the inside and lower part of the legs, and the tip of the tail, are beautifully white; the other parts of the body a rich red, usually darker in the male than the female; the horn is white or light yellow, of a waxy appearance, sometimes tipped with black; the forehead is broad, with spreading horns—those of the bull straight and level with the poll, and of the ox and cow slightly curved, with an upward tendency; the eye is full, yet passive, denoting the quietness of disposition and temper characteristic of the Hereford, and which is of paramount importance to insure the profitable feeding of all ruminating animals; the cheek is fine; the head small in proportion to the carcass, which is long, level, and cylindrical; the hide is thick, yet mellow, well covered with long, soft hair, having a tendency to curl; the brisket is prominent, the chest well expanded, and the breed is pre-eminently distinguished for neatness of shoulder—the bone being thin and flat, the kernel full up the outside shoulder, well covered with mellow flesh, the chine good, the loin broad, the hips wide and level, the whole back displaying a straight line, well covered with flesh, from the head to the tail; the twist, flank, and fore-flank are good—the outside thigh is the most defective part; the whole body is well covered with rich mellow flesh, yielding with pleasant elasticity to the touch; the legs are short and the bone small, and the whole contour displays great constitution, and exhibits, perhaps, a larger amount of flesh in proportion to bone than any other breed." To this we should add that the fore-quarters of the Hereford seem to have hardly sufficiently attracted the attention of their breeders; though the shoulder is good, we often find too little capacity of chest and too flat a fore-rib. The hips are developed at the expense of the loin and quarter, and the preposterous gaudy rumps often seen on a fat Here-

ford are accompanied with a loss of thickness in the thigh and a deficiency in the twist. Size is sometimes considered gained when height on legs, without corresponding depth and breadth, is obtained. In many good Herefords the head is wanting in style and carriage, owing to the setting on of the neck to the body being lower than the shoulder; this gives the animal a dull, awkward air. In size the Hereford ranks next to the short-horn, attaining very nearly as great weight at not quite so early an age. The rivalry between these two breeds at the Smithfield and other fat-cattle shows has always been vehement, and has continued for years with such varying success that it is difficult to gather the result; but we think it now generally conceded that the short-horn cow has usually beaten the Hereford cow, whilst the ox of this latter breed has oftenest carried off the gold medal from his short-horn competitor; and this same distinction seems to prevail among store animals, the graziers preferring to buy short-horn heifers and Hereford steers.

This race of cattle has long been famous for its oxen and steers; and when these animals were more used in England for the plough the Herefords were deservedly popular for that purpose. Though less active than the Devon, their greater weight and strength, together with their docility, caused them to be sought after for the stronger and more tenacious soils. Now, however, the ox has given way to the horse, and he, in his turn, beneath the imperative demand of increasing population, is yielding to the mighty agent steam; and the patient ox no longer tugs at the yoke, but is chiefly in request for feeding, for which his character of form, early maturity, and aptitude to fatten render him highly distinguished. Though not quite equal to the short-horn in early ripening, the Hereford at two and a half years is generally fit for the shambles, and yields a well-marbled beef, a little disposed to be coarse in the fore-quarter, and a fair amount of tallow; though it is allowed that a Hereford bullock shows every pound of meat, and rarely proves better than he looks. The Hereford produces less beef at the same age than the short-horn, but at the same time consumes less food. His hardihood is equal to that of the Devon, and he will bear neglect and short rations better than any breed we know. On the bleakest hill-side, and with the poorest food, without shelter or care, exposed to extremes of heat and cold, he thrives, and with the first gleam of prosperity rapidly grows and fattens. As a dairy cow, few have claimed much for the Hereford, and no authentic evidence warrants us in believing she has any pretensions as a milker. That this is the effect of neglect by their breeders there is little doubt; but it has become so fixed a defect in the race now that the exceptions to the rule are rare. The custom, too, of allowing the calves to run with their dams, so prevalent among the Hereford farmers, adds to the evil; as soon as the calves are removed, at six months old, the cow goes dry! Herefordshire notoriously relies upon Wales and Devonshire for its butter; and even the few dairies kept in the county are chiefly composed of crosses of the Devon.

It has long been a matter of surprise to us that this vigorous, hardy breed, possessing so many valuable characteristics, especially for a new country where ox labor is commonly required, has not secured a firmer foothold and a wider favor in the United States. Disputing the palm with the short-horn as a beef producer, almost equal to it in early maturity, possessing superior hardihood and endurance, and better fitted for the yoke, while for grazing on many qualities of land it is much preferred, we consider them eminently fitted for the great beef-growing districts of the west, as well as for those portions of the north and east where meat and labor are the leading objects for which cattle are kept. Their comparatively moderate cost, at least as compared with their rivals, the short-horns, brings them within the reach of almost all farmers, whilst their strong constitution fits them peculiarly to rough it; at the same time, no breed better repays care and good feeding. We think they have but to become known to be eagerly sought for by the butcher as well as the feeder.

Crosses of the Hereford with other breeds are not common in their native country; they are generally bred pure, little being thought to be gained by their admixture with other races. In this country, however, they have been crossed with the "natives" with admirable results. Mr. Clark, of Otsego county, New York, has a small herd of thorough-breds, and has used his bulls upon large numbers of native cows, his grade stock being numbered by hundreds, so that a fair deduction can be drawn from his experiments. The produce of this cross retains much of the Hereford character, the color here, as in most other instances following that of the pure race, a herd of grades in this respect being scarcely distinguishable from pure-breds. The steers are vigorous, large, and well developed, superior even to the Hereford in hardiness, with an early maturity, and a propensity to fatten that make the animals valuable for grazing as well as for the yoke. As oxen they are excellent, having size, activity, and docility, and from their uniformity of color they are easily matched. The heifers being bred from good selected dairy cows retain much of the milking property of the dam, whilst in form, constitution, and size they follow the sire, thus producing a useful animal for the pail, and one that when fed yields a profitable return to the farmer. From personal observation for some years we can safely recommend this cross as fitted either for the small farmer on the rough hills and with the rigorous climate of the northern or eastern States, or for the man who feeds his hundreds of steers on the rich cornfields of the west.

As some attention has been paid of late years to the pedigrees and breeding of the Herefords, a record has been found desirable, and a herd book was first published in England in 1846, the third volume appearing in 1858. The number of bulls recorded is 1,477.

AYRSHIRES.

This variety of cattle comes within our definition of a *breed*, having been produced by a proper selection and crossing within the last 75 years, and here we cannot help digressing an instant to remark that those who advocate establishing a breed of cattle from our own "natives" by selection and care, little estimate the labor of the work they propose, rendered even more difficult in our case by the heterogeneous mass of mongrel blood composing the material out of which we have to mould our improved breed. The defects that are to be removed, and the good qualities that are to be increased and rendered hereditary, the unexpected faults that will continue to crop out from the want of any strong predominant strain of blood to overcome them, will make the task so arduous that any one having a true conception of what was to be accomplished and through what obstacles, would never advise this mode of proceeding. Almost a hundred years have been required to bring the Ayrshires to perfection, and yet the originators of that breed had, as we shall see, a far more uniform material from which to establish it, and did not hesitate to employ crosses of the improved breeds to attain their end. The true way to ameliorate our "natives" is by crossing with some one of those breeds already approaching perfection. By this means we turn to the best account the want of hereditary qualities, this very defect fitting them especially to receive the impress of the pure race. One single cross of a pure-bred animal would do more towards their improvement than years of selection and breeding among themselves. But to return to the Ayrshires.

They are named from the county in Scotland where they originated and are chiefly bred. It is a high exposed region of cold clay soil, with bleak hill-sides, and vast tracts of moorland, covered with heather, the resort of the grouse and other kinds of game. The climate is mild and damp; grain growing is little practiced, but the attention of the farmer is principally turned towards the dairy as a source of profit. In perfect keeping with this description of land is the hardy little Ayrshire, their breeders having discovered the great secret of success

in thoroughly adapting the animal to the locality and climate where it is to live, as well as to the purpose for which it is to be kept. The origin of this breed is, even at the present day, a matter of uncertainty. Little else is known beyond the fact that there was in Scotland a breed that, though bearing little resemblance to the improved Ayrshire of the present day, might have been their progenitors. Mr. Aiton, in his treatise on the dairy breed of cows, thus describes the Ayrshire cattle of seventy years ago. "They were of diminutive size, ill-fed, ill-shaped, and they yielded but a scanty return in milk; they were mostly of a black color, with large stripes of white along the chine or ridge of their backs, about their flanks, and on their faces. Their horns were high and crooked, having deep ringlets at the root, the plainest proof that the cattle were but scantily fed; the chine of their backs stood up high and narrow; their sides were lank, short, and thin; their hides thick, and adhering to the bones; their pile (hair) was coarse and open, and few of them yielded more than three or four Scotch pints (a Scotch pint is two English quarts) of milk per day when in their best plight, or weighed, when fat, more than from twelve or sixteen to twenty stone avoirdupois, sinking offal," (about 200 to 300 pounds the four quarters.) From this description it is evident that a long course of selection, and better feeding and keeping must have been resorted to, guided by no ordinary skill and perseverance, to have produced the present class of stock, the true type of a dairy breed. We may well doubt, also, whether these means alone could ever have effected the entire change in appearance and thrift from the old breed without assistance from crosses of foreign blood. The color, the horns, the large bellies, &c., could scarcely have been so entirely changed without some admixture of blood, and tradition points to the Holderness as having been one source of the improvement; whilst the Jerseys are also supposed to have lent their aid to the increase of its dairy qualities. We ourselves incline to the opinion that the Holderness or Teeswater was the cross employed to effect the object. Youatt says: "In many a district the attempt to introduce the Teeswater breed, or to establish a cross from it, had palpably failed, for the soil and the climate suited only the hardihood of the Highlanders; but here was a mild climate, a dairy country; the Highlander was, in a manner, out of his place; he had degenerated; and the milking properties of the Holderness and her capability of ultimately fattening, although slowly, and at a considerable expense, happily amalgamated with his hardihood and disposition to fatten, and there resulted a breed bearing about it the stamp of its progenitors, and, to a very considerable degree, the good qualities of both." But let the cross have been what it may, the result is most satisfactory; and the characteristics imparted by it are now so firmly fixed in the improved breed that they can be depended upon to transmit their properties to their offspring, and this test of a true breed they have now stood for many generations, establishing themselves as a distinct breed. They have deservedly attained the highest position as a dairy animal, and as such have spread into many parts of England, and in small numbers have been imported into this country. Mr. Prentice, of Albany, and Mr. Brodie, of Jefferson county, New York, have imported Ayrshires, and quite a number have been brought into Massachusetts, where they have attained considerable popularity.

The Scotchman's beau ideal of an Ayrshire we gather from personal observation and conversations with some of their principal breeders, during a residence of some months in the county, to be as follows: The head must be small, light, and bony, the eye bright, and the horn white, with a dark tip, and upturned. The neck must be very thin and light, as indeed the whole fore end must be. The shoulder must lay flat and form a plane with the flat fore-rib and the neck; the point must not project. The posterior ribs must spring well from the backbone, and give ample room for the large rumen and intestines; the stomach in this breed often seeming wholly out of proportion, but the Ayrshireman admires a big belly as the laboratory where the secretions are

rapidly and properly elaborated, and where the stock of food is converted into milk. The loin must be broad and form well on with the wide hips and the capacious pelvis, the whole frame thus forms a true wedge with the point at the shoulder. The rumps are wide and tolerably high, the tail long and slender, the legs straight, the thigh rather thin, and the udder or "vessel," as they term it, must be large and broad, extending well forward with thin flexible skin, and teats wide apart and short. The offal is small and the weight of the whole animal does not average throughout the country over 500 pounds. The colors must be red and white, splashed and blotched, not running into each other, and becoming roan, as in the short-horn, but with clearly defined edges; the white portion is often flecked with the darker color. Black and white is not uncommon, but is not liked; the darker the red, even becoming deep brown, the more fashionable just now. The skin must be thin and loose, the breed having no great pretensions to handling, and the hair soft and woolly. Everything of the carcass has been sacrificed to the udder and belly, the breeder evidently believing in "no udder, no cow."

Perhaps no breed affords a better illustration of the power of the breeder by care and design to develop a peculiar property in an animal at the expense of all the other qualities. Among the Ayrshire breeders any animal showing a disposition to feed instead of to milk is immediately disposed of, and even those bulls are preferred having the most feminine character about the head. The system of keeping and rearing also conduces to increase their disposition to milk. The calves are never allowed to suck their dams, but are fed new milk for five or six weeks, at the end of that time it is gradually diminished for two or three weeks longer, when the calf is left to shift for itself. After the first year the heifers are generally turned upon the poorest, coarsest pasture on the "moor-edge" where the sedgy grass contains so little nutriment that to satisfy their hunger they are obliged to consume a large quantity of it; this bulk of food of course enlarges the paunch, distending its walls and the belly plates of the young animal, and producing the large belly the Ayrshire farmer so values. The heifers usually calve at two and a half to three years old, though some are in milk at two years old. The usual yield of the cow is from thirty to fifty pounds of milk per day, producing in the season about one hundred and fifty pounds of butter, or "her own weight" in cheese, as the phrase is; though we think three hundred and seventy-five to four hundred pounds would be nearer the average. Youatt, in his account of the Ayrshires, gives much greater products as being obtained, and no doubt instances are found of such extraordinary yields. We quote a few of his figures: "An Ayrshire cow may be reckoned to yield two hundred and fifty-seven pounds of butter per annum, or five pounds per week, all the year round." Six hundred and fifty gallons of milk is called an average yield of a cow, making four hundred and thirty pounds of cheese, or one hundred and seventy-five pounds of butter. This was the average of a herd kept near a town, and highly fed and well cared for, and this would, no doubt, exceed the average of dairies. Thirty-six quarts per day have been milked from a cow, and twenty-eight quarts from a three-year old heifer, and this last for six weeks after calving. Though this breed are chiefly celebrated for the dairy, the oxen work kindly, and the steers can be turned off at three years old, weighing seven or eight hundred pounds. Curiously enough, there seems a lurking tendency in them to fatten, whether resulting from the short-horn cross, or from their natural vigor, it is impossible to say, but it is certain that when transferred to the fertile pastures of England they often lose, in a degree, their extraordinary milking property, and begin to lay on flesh, and the time of their remaining in milk is shortened when removed from their native pastures. They have never been great favorites with the butcher, as the *fifth* quarter is usually light; their fat is mingled with the flesh rather than separated in the form of tallow.

Few experiments that we are aware of have been made in crossing the Ayrshires. Some breeders are of opinion that a cross with the short-horn may be made with advantage, giving earlier maturity and size without loss of milking property, and the appearance of some of the improved herds in Ayrshire would lead us to suppose the experiment had been tried there. We have seen animals among them so square and broad, even in the fore-quarter, as to resemble miniature short-horns. But the cross is not acknowledged, and the opinion therefore needs confirmation. With our native stock the Ayrshire has been crossed with success, an admirable, hardy dairy cow being the result; in confirmation of which we give the statement of Mr. Brooks to the Massachusetts Board of Agriculture, in presenting four grade Ayrshire cows for premium as a dairy herd. In twenty days the four cows gave 3,075¼ pounds of milk, being an average of 768¾ pounds, or 38½ pounds per day from each cow. From the milk 129 pounds of butter was made, being an average daily yield of 1.61 pound per cow. The per cent. of butter in the milk was 4.176; the live weight of the four cows was 4,122 pounds; and the daily yield of milk 3.732 per cent. on that weight! Several of the large dairies in Delaware county, New York, a county chiefly devoted to butter-making, and yearly increasing in reputation and wealth from that course of farming, have used Ayrshire bulls in their herds with manifest advantage, the progeny giving an increased quality and quantity of milk, and, at the same time, not growing too large a frame or too great a weight for the steep, rocky pastures where they feed. The cross is growing in popularity, and we are informed by a gentleman who has sent Ayrshire bulls into the county that the demand for them steadily increases. To such dairy districts as this either the pure-breds or the grades are admirably adapted, and, with proper treatment and not too much indulgence to the pure race, they will retain their milking property as well as in their own country. The milk of the Ayrshires is remarkably rich in casein and good in butter, though yielding in this last respect to that of some other breeds.

GALLOWAYS.

This breed, though but little known in the United States and only lately introduced into Canada, we consider so valuable and so adapted to certain of the colder and more barren districts of our country, that we are induced to make brief mention of it here. The Galloway constitutes one of the most important breeds in Scotland, and made its appearance in the Lowlands within the last hundred years. Up to that time the cattle of the country were chiefly horned, like the rest of the Highland Scots. Since then the polled beasts, of which there were some even then, have gradually supplanted the horned breed, being much preferred by the English graziers as being more docile and kindly feeders. About the time of the general *revival* in agriculture, Lord Selkirk had his attention drawn toward the improvement of the stock of his own county, and he began his experiments upon the polled breed, and by selection and care raised it to the most prominent position among the Scotch cattle. Since his day many good breeders have continued the work, and brought them to the high state of perfection in which we now find them. Youatt thus describes the Galloway of the present day: "They are straight and broad in the back, and nearly level from the head to the rump. They are round in the ribs, and also between the shoulders and the ribs and the ribs and the loin. They are broad in the loin, without large projecting hook (hip) bones. In roundness of barrel and fulness of rib they will compare with any breed, and also in the proportion which the loins bear to the hook bones or protuberances of the ribs. The Rev. Mr. Smith, the author of the 'Survey of Galloway,' says that 'when viewed from above the whole body appears beautifully rounded, like the longitudinal section of a roller.' They are long in the quarters and ribs, and deep in the chest, but not broad in the twist. The slightest inspection will show that there is less space

between the hip bones and the ribs than in most other breeds, a consideration of much importance, for the advantage of length of carcass consists in the animal being *well ribbed home*, or as little span as possible lost in the flank The Galloway is short in the leg and moderately fine in the shank bones; the happy medium seems to be preserved in the leg, which secures hardihood and a disposition to fatten. With the same cleanness and shortness of shank there is no breed so muscular above the knee, while there is more room for the deep, broad, capacious chest. He is clean, not fine and slender, but well-proportioned in the neck and chaps; a thin and delicate neck would not correspond with the broad shoulders, deep chest, and close, compact form of the breed. The neck of the Galloway bull is thick almost to a fault. The head is rather heavy, the eyes are not prominent, and the ears are large, rough, and full of long hairs on the inside. The Galloway is covered with a loose, mellow skin of medium thickness, and which is clothed with long, soft, silky hair. The skin is thinner than that of the Leicestershire, but not so fine as the hide of the improved Durham breed; but it handles soft and kindly. Even on the moorland farms, where the cattle, during the greater part of the year, are fed on the scantiest fare, it is remarkable how little their hides indicate the privations they endure. The prevailing and fashionable color is black; a few are of a dark brindled brown, and still fewer speckled with white spots, and some of them are of a dun or drab color, perhaps acquired from a cross with the Suffolk cattle. Dark colors are uniformly preferred, from the belief that they indicate hardiness of constitution."

The Galloway is essentially the grazier's beast, being little fitted for the dairy, though the milk is rich. Great numbers of heifers are spayed, and then make superior fat animals. The calves are allowed to suck their dams for some time, until they begin to eat, when they are gradually weaned by allowing them to suck but two teats, while the other two are being milked. When the milk is finally discontinued they are turned into fresh grass, They are well kept the *first* winter, the Galloway farmer believing that if once checked at that age in their growth they rarely attain the size or feed as well afterwards. But after the first season they are left to rough it, being rarely housed and only fed, during the winter, a little hay or straw in the fields, picking up the rest of their food from the dead "fog" left from the summer's grass. As may be inferred from this treatment, these animals are very hardy, and at the same time quiet and docile, entirely differing from the vicious, restless little Highlanders, their forefathers. They do not arrive very early at maturity, but at three and three and a half years old will weigh from six to eight hundred pounds, and when older they can be fed up to fourteen hundred without difficulty. The spayed heifers are rather smaller than the bullocks, but they are fit to turn off at an earlier age and their meat is considered more delicate. They are usually spayed when calves, and the operation is no more difficult or dangerous than that of castration.

At the Smithfield fat-cattle show, in 1861, a black Galloway cow was shown by Mr. McCombie, of such remarkable merit that some of the critics went so far as to say she should have won the gold medal for the best fat cow of any breed, instead of the short-horn cow to which it was awarded. We copy the remarks of the Mark Lane Express about this animal: "Here we have unquestionably the best Scot that has put in an appearance for many a year, perhaps the best that was ever seen. Not only is her form so perfect—back, rib, shoulder point, breast end, loin, hip, flank, and rump—but her thigh and twist are wonderful, the rounds of beef full and heavy to the very hocks; her head is beautiful, exactly characteristic of the breed; her coat just what it should be, and she handles like what she is, a magnificent feeder, of a quality worth something to the butcher, and calculated to make the appreciative epicure smack his lips. In proportion to her symmetrical figure elsewhere, her girth forms her

weak point; but even this is eight feet nine inches at four years and ten months old." Such commendation as this, among so many superbly fatted animals as are annually collected at the Smithfield show, speaks volumes for the feeding qualities of the Galloway.

It is a curious fact that so thoroughly indigenous and acclimated is this breed to their native county, that all crosses of them with improved breeds, have been inferior to the pure race; even the short-horns have failed here to communicate the improvement they have been proverbial for doing in almost all other instances, and the Galloway breeder now wisely confines his attention to the improvement by selection and care of his own native breed. We are inclined to think, from the uncommon hardiness and vigorous constitution of this breed, together with their property of laying the fat on the most valuable parts, and the superior quality of their beef, that there are portions of our country where they would be more profitably bred than some of the larger races of cattle. There are large tracts, of greater or less extent, along the whole range of the Alleghanies, as well as in the northern portions of New York and the New England States, which might be occupied with advantage by some hardy breed of cattle, adapted to the climate and region, whose product of beef would be remunerative, and whose constitutional vigor would enable them to live and thrive in those localities. We think were the Galloways introduced into such situations they would be found admirably suited to them, and would soon acquire the reputation and value in our markets that their well recognized quality of meat gives them in England.

JERSEYS OR ALDERNEYS.

The Jerseys or Alderneys, or, as they are called in the prize sheet of the Royal Agricultural Society, the "Channel Island cattle," are, as their name indicates, natives of the group of islands belonging to England lying in the British channel, about twelve miles from the coast of France. The largest of the group is Jersey, about twelve miles long by five broad, with a population of nearly fifty thousand, and here the larger number of cattle are bred, those on the other islands being inferior in quality. The breed, no doubt, was originally brought from France, the cattle of Normandy and some parts of Brittany presenting a strong resemblance to the Jerseys, though very inferior as regards the milking property. It is for this latter property alone that the Jerseys are kept and valued, and for this point they are bred, little care being bestowed upon any other point, and, as in the case of Ayrshires, careful breeding and selection with regard to the one property of milk has been crowned with remarkable success. Of late years, however, some attention has been paid to improving the form, while the milking quality has not been allowed to deteriorate. This reform, we are told by Colonel Le Conteur, was effected by judicious crossing among the limited number of animals on the island, all importations of cattle being forbidden by law, and by the greatest care and attention in bringing the right individuals together, and in the selection of the progeny none but the very best being reserved.

In the time of Culley these cattle were so rare in England that he almost excuses himself from mentioning them among the breeds of cattle, as they were only seen in the parks of a few noblemen and gentlemen. Since then, however, they have been largely imported into Great Britain, and the peculiar richness of their milk is so highly appreciated that many dairies keep a Jersey to every ten or twelve cows to give "character" to the butter. Culley supposed they would prove altogether too delicate for even the climate of England, and the belief is a natural one, when we remember the soft, genial climate of the islands where they are bred. Frost rarely injures vegetation there, whilst the camellia and the tea-rose flourish unprotected in the open air! From this delicious and equable temperature the Jerseys have have been brought, not only into the

damp climate of Great Britain, where they quickly become acclimated, but even into the almost Arctic rigors of our northern winters, without loss or suffering. The writer has had imported Jerseys kept by the side of natives, faring exactly alike, with only an open shed for shelter in winter, and has never seen them evince the least delicacy or even sensibility to a temperature many degrees below zero—an extraordinary instance of the ready powers of acclimation in animals. In their native island the cows are treated with great care, almost forming one of the family, comfortably housed in wet and stormy weather, and fed on the best grass and roots the little farm affords. When at grass they are usually tethered by a rope round their horns, fastened by a stake driven into the ground, allowing them a circle of about sixteen feet diameter, and this is moved three times a day, as they require fresh food. The chief care of the cattle is taken by the farmers' wives, few possessing more than two or three cows. They are very docile and affectionate. The bulls have the reputation of becoming cross and vicious as they grow old, but we think this must be from mismanagement or carelessness, as, in a number that we have bred and owned, we have never had an unmanageable one. In most cases of vice in domestic animals the cause is oftener in the man than the beast.

The first importation of this breed into the United States was made by Nicholas Biddle, of Pennsylvania. They were not the best specimens of the breed, being coarser and larger boned than the Jersey of the present day, and rather resembled the Guernsey cow. The descendants of this stock are still to be found in the neighborhood of Philadelphia. Some years after Mr. Roswell Colt, of Patterson, New York, imported a superior herd of these animals, to which he from time to time added until his death, when it was sold. Various smaller importations have, of late years, been made, among the most prominent of which those of Mr. Thomas Motley, of Massachusetts, and Mr. Tainter, of Hartford, Connecticut, may be mentioned. The latter gentleman, especially, has imported over one hundred animals, and been the means of disseminating them far and wide through the country. No breed seems to have sprung into greater favor within the last few years; and, though no large herds of them are kept, they are becoming generally known and diffused. Wherever, in the vicinity of cities or towns, one or two cows are kept for the supply of a family, the Jersey deserves a place; her gentleness and small size, and her rich milk, make her all that can be desired in a family cow. In such a position few who have ever used her delicious cream and butter would willingly do without her.

The Jerseys are so totally unlike any other of the improved breeds that they are recognized at a glance—their peculiar colors and deer-like heads being distinguishing marks. Their chief characteristics may be described as follows: The head of the cow (to which we shall confine our description) is small, thin, and rather long; her horn is short, delicate, and curved forward, white with a dark tip; her muzzle is black, and encircled with a band of light color, as is the eye, which is bright, large, and prominent; her ear is small and flexible, the inside skin being bright yellow; her neck is thin and delicate, and of medium length; her shoulders thin and sloping, and forming with the fore ribs a gradual slope outward to the hips; the back tolerably straight from wethers to setting on of tail, though generally with some sway from the size and weight of the stomach, which is large; her loin is moderately wide, and the hind-quarters well spread, and pelvis roomy; her tail is long and delicate, with a full brush at the end; the thighs are thin; chest deep, though narrow; legs very fine below the knee; hocks slightly turned inwards; udder large, reaching well forward, with teats of moderate size, placed wide apart; skin thin, and not too loose; hair smooth and fine. The color of the Jerseys varies; yellow, yellow and white, mouse color or dun, brown, and almost black, are the chief tints. The bulls are usually darker than the females, and the depth of color increases with age. Many a young breeder has been disappointed by finding his beautiful yellow

and white calf growing browner and browner, till at a year old it has scarcely a trace of yellow left! The head of the calf is strikingly like that of a fawn, and at all ages the peculiar coloring, large dark eye, and flexible ear, give the head a deer-like look; and the aspect of the whole animal, with its delicate limbs and head, notwithstanding its usually low condition and unsymmetrical form, is very blood-like.

The milk of the Jersey cow is particularly rich in butyraceous particles, and is of a deep yellow. The butter made from it is always of a rich golden color, and this character is so strong that a few cows will be enough to give the butter of a whole dairy that desirable hue. As ascertained by the lactometer, the amount of cream varies from 19 to 25 per cent. At the same time, the quantity of milk given by the very best cows is not large. Colonel Le Couteur says some of the best give 26 quarts in the 24 hours, and 14 pounds of butter per week; but we must own we have never been fortunate enough to find many such. We consider 16 quarts per day a good yield, and many do not give that. But it should be remembered that from the quality of the milk from one-sixth to one-quarter of this is cream of the richest description. As compared with the Ayrshire, the milk contains more butter. Professor Thomson's analysis of the latter's milk, made by order of the British government, gives the per cent. of butter as 3.70 in 100 parts. Professor Emmons's analysis of the milk of a Jersey cow belonging to Mr. Tainta gives 8.07 parts in 100, whilst good milk from the milkman's cans gave 2.88 per cent. in 100! Mr. Tainta's cow at that time (February, 1850,) was giving 11 or 12 quarts daily, which would make her yield of butter 12 pounds 3 ounces 5 drachms per week. In the same time the Ayrshire experimented upon by Professor Thomson gave 5 pounds 3 ounces 11 drachms—so small a yield that we cannot consider her a fair sample of that excellent breed. There is no question, however, that the Jersey far excels any other race in the quality of milk.

The Jersey is not a large consumer, even in proportion to her size, and when dry thrives fast; and though never making much outward show of fat, they generally "die well," the fifth quarter being large. The calves, when fattened for the butcher, rarely look fit for the knife, but usually make a very good show on the block. It is contended by some that when dry the cows will yield a good return as beef for feeding, the quality being good, though the fat is rather yellow. Colonel Le Couteur says an old cow was put up to fatten in October, 1850, weighing 1,125 pounds, and when killed, in January, 1851, she weighed 1,330 pounds, having gained 205 pounds in 98 days on 20 pounds of hay, a little wheat straw, and 30 pounds of roots, consisting of carrots, swedes, and mangle-wurzels, a day! The general appearance of the Jersey, with her want of handling, would lead us to infer she would feed slowly; and we cannot be misled in the way she lays on her flesh, little being put on the external frame—a further proof of the truth of our position as regards *handling* as a sign of feeding properties.

Not many authentic experiments have been made in crossing the Jersey. Quayle, an old writer on the agriculture of Jersey, claims the Ayrshire to have been bred from a cross of the short-horn and Jersey; but from the individual instances of that cross, already mentioned, that have come under our own observation, we should hardly coincide in the opinion, considering the two breeds to be too entirely opposite to ever mingle well. The cross of the Jersey upon the native has been tried in a few dairies in Otsego county, New York, and the results thus far are promising. The quality of the milk in every instance is much improved, closely resembling that of the pure breed, whilst in quantity it is but slightly diminished from the native yield. The rich color of milk, cream, and butter is transmitted to the cross-breed very strongly. The frame of the progeny is, of course, not at all improved, although in size it exceeds that of the

Jersey. The distinguishing colors of the Jersey parent are often found in the produce, and the general resemblance about the head is striking, which fact, as the cross has always been made with a *sire* of the pure race, would go to support the theory that the male parent transmits the head. How far this cross will prove desirable, and how the ultimate end of all cattle, *beef*, will be attained by it, remains to be seen; but it is certainly deserving of a trial, and we think that a few cross-breeds in a dairy will always be of advantage.

Having thus briefly given the history and peculiarities of the several breeds of *English* cattle, from which we have drawn our supplies of improved blood, we will glance at the few remaining breeds that have found their way to this country.

The Kerry cow—one of the indigenous Irish breeds—has, as we have above observed, been very lately imported into Massachusetts; but time enough has hardly elapsed to decide upon her adaptation to this country. There may be a few districts where this hardy little animal will find a place; but we question whether, among the various improved breeds, an animal cannot be selected of equal hardihood and more symmetry, with sufficient milking property. Youatt calls them "truly the poor man's cow; living everywhere hardy, yielding for her size abundance of milk of a good quality, and fattening rapidly when required;" but they are rather apt to be coarse in the head and deficient in the hind quarter, with a certain cloddiness of the shoulder. They are short-legged, with good hides covered with thick, long hair; their horns are fine, short, and turned upwards; their colors are black, brown, or brindled. They are exceedingly hardy and active, almost disposed to wildness, and live on the mountains and moorlands of their native country without shelter or care. The quality of their milk is very good. In an experiment made between the Ayrshires and grade Kerrys—the cross being with the long-horned Irish, and not calculated to improve the milking of the former—the milk of the Scotch breed required $9\frac{9}{10}$ quarts to make a pound of butter, whilst $8\frac{1}{5}$ quarts of that of the Irish cows yielded a pound of butter; making a yield of one-sixth more butter in favor of the Kerrys. Mr. Bogan, who conducted the experiment, states that the color of both the milk and butter of the latter was the richer of the two. It must be taken into consideration, though, that the Ayrshires were just imported from Scotland, and had not time to become acclimated. A further experiment, made by the same parties, on the crown estate at King Williamstown, between Galloways, Ayrshires, and Kerrys, resulted as follows: the Galloways averaged six and a quarter quarts per day, requiring $9\frac{1}{2}$ quarts to produce a pound of butter; the Ayrshires gave nine quarts of milk per day, requiring $10\frac{1}{5}$ quarts to produce a pound of butter; the Kerrys gave seven and a quarter quarts per day, requiring $8\frac{7}{8}$ quarts to produce a pound of butter. The Galloways were but three years old, with their first calf; the Kerrys were four years old, and the Ayrshires six years old. In both these trials the Kerrys proved themselves good dairy cows, and we await with some interest the result of their importation into Massachusetts.

The Dutch cattle that have occasionally been brought to this country have the reputation of being good milkers, and, as North Holland is exclusively a dairy district, we should expect to find good cows there; but the specimens that have reached our shores are not such as to induce us to resort to that country for our dairy breed. They are generally coarse, ill-proportioned animals, with hard hides, and rarely take on flesh well, and its quality is inferior at best. They are of various colors—black, brindled, red, dun, and white. The spotted cows are held in the most estimation in their own country. Several years since a cross of this breed with the natives attained some celebrity as a dairy cow in the neighborhood of New York; but of late we have not heard anything of it, and it has probably died out.

The Swiss cattle we are not aware have ever been imported into this country;

and yet they bear a high reputation in many parts of Europe. In France, especially, they are much esteemed, and at the agricultural school of Grignon we saw numbers of them in milk, and their performances at the pail compared well with those of the common short-horns, which were considered the best milkers in the establishment. They are a robust, hardy animal, usually of a dun color, or dun and white, with medium heads, hanging dewlaps, rather coarse shoulders, and broad hips and quarters, with well-developed udders. Removed from their native mountains, they manifested little impatience at the change, and though kept in stables and soiled, they seemed to thrive, and carried a good coat of flesh; when dry, they are said to fatten readily. In Switzerland they are wintered in the valleys, on the coarsest food, and as soon as the snow melts from the southern slopes of the mountains are driven to their pastures, which, as the season advances, are gradually changed for the higher ranges. For four months in the year they are kept on the most elevated feeding grounds, or "alps," as they are termed; and there, attended by a single man, uniting in his person the offices of cowherd and dairy-woman, they feed on the close, sweet herbage, often at the very edge of the snow fields, till their short summer is over, and they are driven by the autumn storms to the more sheltered pastures again. Cheese is the chief product, and its manufacture is conducted in the lonely chalet, perched on the mountain side, in the most primitive manner. A few pails and tubs and an iron kettle are the only utensils required. The best cows yield from ten to twenty quarts of milk daily, and each cow produces, by the end of the season of four months, on an average, 225 pounds of cheese. The best cheeses are made upon pastures 3,000 feet above the sea level! How far the introduction of these cattle into our country might be of advantage is a question; but there are districts which, though not absolutely alpine in their character, are sufficiently rugged and bleak to require for their profitable occupation a breed of this kind, especially as with better keeping and a milder climate they proportionably improve in both milk and form. They have even been imported into Scotland; and in the Farmers' Magazine for October, 1842, we have a spirited portrait of a Swiss bull imported by Sir F. A. Mackenzie as a curiosity, we imagine, rather than on any other account, as the variety of improved breeds of Great Britain are suited to every locality within its limited boundaries.

And here we close our descriptions of the various breeds of cattle that have exercised or may in the future exert an ameliorating influence upon the stock of our country. To compare these several races, and to decide between their relative merits, would be difficult if not impossible. They present a great diversity of form and habits and properties; they have been bred for many generations with a specific purpose, and the features thus impressed upon them have become fixed and hereditary, and cannot now be easily altered; they are fitted to the localities that produce or support them, and to the peculiar circumstances of climate, food, and markets that attend those localities. It is only by studying and thoroughly comprehending the peculiarities of the separate breeds, and as fully understanding the requirements and advantages of the position, the soil, and the climate to which we desire to remove them, that we can make a prudent or a successful choice. In reply, then, to the often-repeated question. "Which of all these breeds is the best for general use?" we can but reply, in the words of a writer frequently quoted, (Goodale, page 127,) that "it may be said no breed can possibly fulfil all requirements in the best possible manner; one is better for meat and early maturity, another for milk, and so on. Because under certain circumstances it may be necessary or even advisable for a man to serve as his own builder, tailor, tanner, and blacksmith, it by no means follows that all which is required will be as well or as easily done as by a division of labor. So it is better for many reasons, and more profit can be made by employing different breeds for different purposes than by using one for all, and towards such profitable employment we should constantly aim. At the same

time there is a large class of farmers so situated that they cannot keep distinct breeds, and yet wish to employ them for different uses, and whose requirements will best be met by a kind of cattle which, without possessing remarkable excellence in any one direction, shall be sufficiently hardy, the oxen proving docile and efficient laborers for awhile, and then turning quickly into good beef upon such food as their farms will produce, and the cows giving a fair quantity and quality of milk for the needs of the family, and perhaps to furnish a little butter and cheese for the market." The requirements of this class of farmers will be better met by a *grade* of one of the improved breeds than by a pure-bred animal, for the reasons that the latter are far too costly to be within their reach; they generally demand more care than they would usually receive in such positions, and few are fitted to perform all the duties demanded for the yoke, the pail, and the knife. By securing a pure-bred male, however, of one of the improved breeds, and crossing him upon well-selected *natives*, an animal is obtained that much more nearly fulfils all these conditions. The Hereford, as we have observed, is especially fitted for this purpose, as well as his smaller relative, the Devon, the choice between them depending upon the soil and character of land they are to occupy. Notwithstanding the comparative ease with which animals adapt themselves to change of locality, climate, food, &c., we should as far as possible avoid this source of loss and disappointment by drawing our supplies, whether for cross-breeding or of thorough-breds, from herds already introduced into the country, habituated to the great change from their moist island home, and, as it were, *Americanized*, rather than by going abroad for them, and running the great additional risk of transportation across the ocean. We have now in the country such fine herds of almost all the desirable breeds, and such ample materials within our own borders, that there is no reason why we should not continue the improvement in them commenced long ago in their own country, as well as greatly ameliorate, by crossing, our own native stock. Stock-breeding has now assumed such importance among us, and so much capital and intelligence are now devoted to it, that, whenever necessary, importations will be made by the extensive breeders, and the farmer of moderate means, as well as the country at large, will be able to reap the benefit of their public spirit without the risk they run or the expense they incur.

We cannot better close this article than by quoting the excellent remarks of the writer on cattle in the Library of Useful Knowledge in reference to the choice and breeding of stock. He says:

"At the outset of his career the farmer should have a clear and determined conception of the object that he wishes to accomplish. He should consider the nature of his farm; the quality, abundance, or deficiency of his pasturage; the character of the soil; the seasons of the year when he will have plenty or deficiency of food; the locality of his farm; the market to which he has access, and the produce which can be disposed of with greatest profit; and these things will at once point to him the breed he should be solicitous to obtain. The man of wealth and patriotism may have more extensive views, and nobly look to the general improvement of cattle; but the farmer with his limited means, and with the claims that press upon him, regards his cattle as a valuable portion of his own little property, on which everything should appear to be in natural keeping and be turned to the best advantage. The best beast for him is that which suits his farm the best, and with a view to that he studies, or ought to study, the points and qualities of his own cattle and those of others. The dairyman will regard the quantity of milk; the quality; its value for the production of butter and cheese; the time that the cow continues in milk; the character of the breed for quietness or as being good nurses; the predisposition to garget or other disease, or dropping after calving; the natural tendency to turn everything to nutriment; the ease with which she is fattened when given up as a milker, and the proportion of food requisite to keep her in full milk, or to fatten

her when dry. The grazier will consider the kind of beast which his land will bear; the kind of meat most in demand in his neighborhood; the early maturity; the quickness of fattening at any age; the quality of the meat; the parts on which the flesh and fat are principally laid; and, more than all, the hardihood and adaptation to the climate and soil.

"In order to obtain these valuable properties, the good farmer will make himself perfectly master of the characters and qualities of his own stock. He will trace the connexion of certain good qualities and certain bad ones with an almost invariable peculiarity of shape and structure, and at length he will arrive at a clear conception not so much of beauty of form (although that is a pleasing object to contemplate) as of that outline and proportion of parts with which *utility* is oftenest combined. Then carefully viewing his stock he will consider where they approach to, and how far they wander from, this utility of form, and he will be anxious to preserve or to increase the one and to supply the deficiency of the other. He will endeavor to select from his own stock those animals that excel in the most valuable points, and particularly those that possess the greatest number of those points, and he will unhesitatingly condemn every beast that manifests deficiency in any one important point. He will not, however, too long confine himself to his own stock unless it be a very numerous one. The breeding from close affinities has many advantages to a certain extent. It was the source whence sprung the cattle and sheep of Bakewell and the superior cattle of Colling, and to it must also be traced the speedy degeneracy, the absolute disappearance of the New Leicester cattle, and, in the hands of many agriculturists, the impairment of constitution and decreased value of the New Leicester sheep and of the short-horns. (?) He will, therefore, seek some change in his stock every second or third year, and that change is most conveniently effected by introducing a new bull. This bull should be of the same breed and pure, coming from similar pasturage and climate, but possessing no relationship, or at most a very distant one, to the stock to which he is introduced. He should bring with him every good point which the breeder has labored to produce in his stock, and if possible some improvement, and especially in the points where the old stock may have been somewhat deficient; and most certainly he should have no manifest defect of form, and that most essential of all qualifications—a hardy constitution—should not be wanting.

"There is one circumstance, however, which the breeder occasionally forgets, but which is of as much importance to the permanent value of his stock as any careful selection of animals can be, and that is good keeping. It has been well said that 'all good stock must be both bred with attention and well fed. It is necessary that these two essentials in this species of improvement should always accompany each other, for without good resources of keeping it would be in vain to attempt supporting a valuable stock.' This is true with regard to the original stock. It is yet more evident when animals are absurdly brought from a better to a poorer soil. The original stock will deteriorate if neglected and half starved, and the improved breed will lose ground even more rapidly and to a far greater extent."

If these well-digested remarks and admirable rules are adopted by the farmers of our country, and the adaptation of breeds carefully studied, we feel sure that the great improvement already commenced will be continued until the whole stock of our country is so raised in character that the breeder, feeder, butcher, and dairyman, each in their respective departments, will reap the profit attendant upon improved quality of beef, earlier maturity, and greater milking properties. The increase in the numbers and in the value of our cattle should keep pace with the constantly-extending production of grain, and thus the alarming deterioration of our arable land alluded to at the commencement of this article may be prevented, and at the same time a vast addition will be made to the already enormous value of our flocks and herds.

GRAPES ON KELLEY'S ISLAND, OHIO.

BY GEORGE C. HUNTINGTON, OF KELLEY'S ISLAND, OHIO.

KELLEY'S ISLAND is the easternmost of the group of islands lying in the western end of Lake Erie, and is known on all maps of an earlier date than 1840 as "Cunningham's island." It is in latitude 41° 35′ north and longitude 82° 42′ west, and contains an area of twenty-eight hundred acres.

This island has become somewhat celebrated within a few years past for its growth of Catawba grapes, which are found to ripen here more perfectly than in many localities two or three degrees further south. Theoretically, this island is too far north to cultivate the grape to advantage, but, practically, the success of those who have had faith enough to try the experiment has been all that the most sanguine could desire. The writer has been a resident of the island for twenty-three years, and for the last eighteen years has been practically engaged in the culture of the grape. During the whole of that time nothing like a failure of the crop has occurred, notwithstanding we have had during that period every variety of season incident to the latitude; the coldest winter and the driest summer known to the present generation have occurred within this period. Peaches have been wholly cut off by excessive frost, hay and corn have almost entirely failed from excessive drought; but the grape has withstood these extremes, and the crop has been uniformly good, seemingly without much regard to the weather. Our success in this branch of agriculture bids fair to change the face of the country throughout the entire lake region of Ohio. Within the last three or four years vineyards have been planted along the whole lake coast, from east of Cleveland to west of Sandusky bay, a distance of more than sixty miles; and from present indications this branch of agricultural industry must soon become the leading occupation of farmers throughout this section of country. There are now on the island three hundred and sixty-seven acres in vineyard, one hundred and forty of which are in bearing this season, and the average yield per acre is not less than three tons. About two hundred and fifty tons have been sold as fruit, at an average price of about one hundred and twenty dollars per ton, and the remainder is now being made into wine. The impression very generally prevails that our success has been in a great measure owing to the mode of cultivation which has been adopted here, and which differs in some respects from the directions laid down in most of the books which have been published on the subject within the last quarter of a century. Our system, such as it is, is the result of practical experience. We discovered at an early day that it would not answer to follow too closely the directions as laid down in the books. One of the first innovations which it became necessary to make was to give the vine more room. It was found impracticable to keep them within the prescribed limits without danger of serious injury from excessive pruning; for I presume it will require no argument to prove that a vine which grows twelve to fifteen feet in a single season does not require and will not bear so close pruning as one which grows but four or five feet in the same time. We accordingly threw aside all theories, and commenced a course of experiments with a view to ascertain what kind of treatment was best suited to our circumstances. We studied the habit of the vine, as it appeared under the conditions which existed here, and we governed ourselves accordingly. The result has been that we have reduced the matter to something like a system, which seems to be very well adapted to this locality. Our island has been visited by hundreds of persons, who came for the express purpose of seeing for themselves

how we manage our vines, and we are frequently applied to for specific directions how to begin and how to proceed, in order to attain the same success which has attended our efforts.

I now propose to give, in as plain and concise a manner as is consistent with a full understanding of the subject, all the details of manipulation as practiced by us from first breaking ground to packing the fruit for market.

DRAINING.

This is the first step, and the more thoroughly it is done the more satisfactory will be the result. It may be thought wholly unnecessary to spend any time in describing so simple an operation as the underdrainage of land. But since it is fair to presume that economy is always an object, and since we think that our plan is more effective in operation as well as more economical than the common drain tile, it may not be amiss to describe it. We dig ditches in parallel lines when practicable, and not to exceed thirty feet apart. These ditches should connect with a main drain of sufficient capacity to carry off all the water emptied into it by the tributary drains, and should be at least three feet in depth. These drains may be filled with small stones to within twelve to fourteen inches of the surface. A little straw or litter should then be thrown in to prevent the dirt from washing down and clogging the drain, and then fill with earth to the surface. It is a good plan to leave the drain a little open at the bottom, which may be done by setting up small flat stones upon their edges in the bottom of the drain, the bottoms about three or four inches apart, and the tops leaning together thus, $\wedge$; then fill up with small stones, as before mentioned, to within twelve to fourteen inches of the surface, and then fill up with earth. The ground now presents an unbroken surface, and is ready for the plough. Besides economy of construction and effectiveness in operation, drains made in this way afford a good opportunity to get rid of all small stones, which, if left upon the surface, are much in the way in after cultivation.

The old plan, which has been so strongly recommended by some writers of deep trenching, or digging up the ground with the spade to the depth of two or three feet, is found to be not only a useless expenditure of time and money, but is decidedly a damage. If the land has been thoroughly drained, there is no necessity for ploughing any deeper than the young plants are to be set, say from twelve to fourteen inches. The roots will find no difficulty in penetrating the soil in every direction, and seem actually to do better than when the ground is loosened up by trenching.

LAYING OUT THE VINEYARD.

Much time and labor may be saved by laying out the entire vineyard before any of the young plants are set. Our experience goes to show most conclusively that the vine in this region requires much more room than has usually been assigned to it, and in this respect we have innovated very seriously upon established customs. We set the rows eight feet apart and the plants six feet apart in the row; this gives each vine a surface of forty-eight feet, or 907½ plants to the acre. Since, however, alleys are needed in a large vineyard to facilitate getting about when harvesting, vines set in this way will not average more than eight hundred and fifty to the acre. We consider it as fully demonstrated that a larger crop and better fruit can be raised from eight hundred and fifty vines upon an acre of ground than from twenty-five hundred vines occupying the same space, which is about the usual number in the old vineyards in the southern part of the State. It is even questionable whether the distance might not be increased still further with advantage. Assuming six feet by eight as the distance apart we wish to set our vines, proceed to lay out the entire vineyard as follows: Procure a line of sufficent length to reach across the entire lot north and south; stretch the line where you intend to have the first row;

then tie tags at intervals of six feet along the whole length of the line. This does away with the necessity of measuring for each plant, and insures greater accuracy. Next procure some small stakes, say eighteen inches in length; strips split from shingles will do very well, as a man can carry enough at once to reach across a large field. Stick a stake at each tag, then move the line eight feet parallel with the first row of stakes, and proceed as before until the whole vineyard is laid out. In this way two men will lay out ten acres or more in a day; and if the end stakes are in a straight line the rows will be straight both ways, and will save much labor the first year in tilling, since you can run a horse hoe or cultivator both ways close to the roots, leaving but little necessity for the hand hoe.

It is strongly recommended to have the rows run north and south, for the reason that the sun through the middle of the day shines through the entire length of the rows, and in the morning the east side is fully exposed to the sun, and in the afternoon the west side is in like manner exposed; whereas, if the rows run east and west, the north side is in the shade during the entire day after the autumnal equinox, when the sun's rays are most needed in ripening the fruit. It may be proper to state that the plan of planting east and west has still a few advocates, but a comparison of a vineyard planted in this way with one planted north and south will satisfy any one of the correctness of the principle above stated. The next thing in order is to set out the young vines; this should not be done until the ground is well settled in spring; the first of May is early enough. It is better to set out roots one year old than to use cuttings, as one year in time will be saved thereby.

The usual price of roots one year old is from fifteen to twenty dollars per thousand. Many persons have an idea that time is saved, and that the vineyard will come into bearing one year sooner by setting roots two years old, for which they pay a higher price than for those which are but one year old; this is found to be very bad practice. I had much rather have roots one year old at the same price; the roots are then all fibrous, and do not suffer so much by transplanting. If the roots are carefully set at least ninty-five per cent. of them will grow, and the few vacancies which may occur can be filled by layers from the adjoining vines.

When a vineyard is once started it may be extended more economically by raising roots from cuttings than by buying roots. At the annual winter pruning all well-ripened wood of the previous season's growth may be cut into lengths, having each three buds or eyes. These cuttings, as they are called, may be buried in the ground or put into a cellar until the ground thaws out in the spring, when they should be set nearly their whole length in the ground, leaving the upper eye or bud just at the surface. It is better to set them in beds in the nursery, whence they can be removed to the vineyard when wanted. In setting out cuttings it is better to lay them down at an angle of about forty-five degrees than to set them perpendicularly, since roots sometimes start from all the eyes, and one cutting thus marks two or three roots. When once the young vines are set, nothing further is necessary the first year but to keep the ground clear of weeds during the season.

SECOND YEAR.

In the month of February or March cut away all the wood of the previous season's growth, leaving but from one to two eyes on two of the strongest shoots. If there are more than two, cut them away altogether.

TRAINING.

It is here that we leave the long-established custom of setting a stake, or, as some have recommended, two stakes to each vine, to which the canes are to be secured during the season's growth. Instead of this, we train wholly on wire.

The stakes for this purpose are set in rows north and south, eighteen feet apart, which leaves three vines to each stake. Then stretch three strands of wire the whole length of the rows, the first or lowest wire about eighteen or twenty inches from the ground, and the other two wires about eighteen or twenty inches apart, bringing the upper wire about four feet eight inches to five feet from the ground. The kind of wire we use is No. 9 annealed iron wire, same as used for telegraph. This weighs one pound to the rod, and costs usually five cents per pound. In the usual way of setting in rows eight feet apart, one thousand pounds suffice for an acre; consequently this makes cheaper trellis than we could possibly make in any other way. The cost of putting up is very trifling. Two men, after they get accustomed to handling the wire, will put up an acre or more in a day.

It is convenient for this purpose to have a reel, the cylinder of which should be, say, two feet long, and of a diameter which will admit of a coil of wire slipping on easily. It may be mounted something like a grindstone, and so arranged that it can be raised from its bearings and a coil of wire slipped on. Then, by placing it at the end of a row, the wire is easily unwound from the coil, and secured to the posts with very little trouble. We have tried several ways of securing the wire to the stakes. At first it was the custom to bore a hole through each stake and draw the wire through. This answered very well, but was attended with considerable labor, and unless the wire was secured to each stake by driving in a plug the strain will come upon the end posts, and was apt to draw them out. We have found it much easier and also to be much better to secure the ends, and then drive a small staple into each post, the wire running through the staple, and the staple being driven hard in secures the wire to each post. Thus the strain is divided among all the posts, and the wire is not so likely to draw out at the ends. It is very necessary that the ends be strongly secured, otherwise the contraction of the wire in cold weather is almost sure to draw out the posts. The most effectual way of securing the ends, which we have tried, is to set two posts at each end of the row, say eight feet apart, and put in a brace between them, and then secure the posts firmly together. This will bear a very heavy strain. In uncoiling the wire it will be found almost impracticable to prevent small kinks; these, when not too large, may be left in with advantage; the wire may be stretched as tight as a man can reasonably draw it, and so as to make it horizontal—that is, tight enough to take out the sag. The small kinks will then make the wire somewhat elastic. In cold weather the contraction will cause the kinks nearly to disappear, and in very warm weather the wire will have quite a wavy appearance, and still be taut enough to hold the vines securely.

As regards the use of wire in training grapes there are other advantages aside from saving in first cost. The small tendrils which the vines put forth to sustain themselves seem to have a peculiar affinity or instinct for the iron, and will stretch themselves out, feeling, as it were, for something by which to support themselves, and when they once touch the wire will attach themselves so firmly that a great deal of labor is saved during the season in tying up. Besides this, in high winds the wires sway back and forth, the vines holding on firmly, and thus do not chafe so badly as when trained to stakes, which do not yield at all to the wind. Whether it is possible there can be anything of an electrical influence growing out of the intimate connexion between the plant and the iron, which may account, in some degree, for the very eminent success we have had in training grapes in this way, may be a proper subject for scientific investigation. Certain it is, I have never known grapes trained on wood attain the perfection which we have found to be the rule, and not the exception, when trained on iron.

I would recommend setting the stakes and putting in the wire in the manner described during the second summer after the young vines are set; the roots

are then not so large as to be injured by digging near them; and when once in the vines can be tied to the wire as fast as they get long enough to reach, and are thus kept from running all over the ground, and will allow of using the plough or cultivator between the rows, thus keeping the ground clear of weeds with much less labor than would otherwise be necessary.

THIRD YEAR.

If the previous summer has been favorable to the growth of the vine, some will be found to have reached the upper wire; and some care and judgment will be required in pruning, not to leave too much bearing wood. As a general rule, it is best to cut the two strongest canes down to the middle wire, and if there are any more, cut them down to one or two eyes. These eyes will furnish bearing wood for the succeeding year. The ground should be kept clean of weeds, and the canes tied to the wires as fast as they get long enough to reach them through the summer. There will this year be nearly or quite half a crop, which the vines will bear without any particular injury.

FOURTH YEAR.

In pruning this year great care and judgment will be required to prevent the vines from overbearing. This is found to be almost universally the case in all new vineyards, and it is oftentimes the result of design. It is not uncommon to hear the remark, "I have been these four years spending time and money without any return. I am in debt for my wire, and a good crop this year will do me more good than at any subsequent period;" and to this end they leave nearly all the good bearing wood of the previous season's growth. The result is, as expected, a very heavy yield. The next year you will hear them complaining that their grapes are not doing as well as their neighbors'; that the wood did not ripen as well as it should have done, &c. This is an inevitable consequence of the large crop of last season, and it may be two or three years before the vines entirely recover from the effects of it. It is much better policy to have a little more patience, and be satisfied with a moderate crop, which may be had without any injury to the vines. To this end there should not be left more than three canes to the strongest roots, and they may be tied to the wires, say, one perpendicular, and one on each side, diverging like a fan. These, with two or three lateral spurs to each, will cover the six feet in length allotted to each root. It should be borne in mind that in every winter or spring pruning two objects are to be kept in view: one is to prune the wood of the last season's growth in such a manner as to secure a good crop of fruit without injury to the vines from one bearing, and the other is to provide wood for the next season. This is done by leaving one or two of the lowest buds of the superfluous canes which you cut away; from these buds canes are trained to bear the next season. This is what we call the "renewal" system, and we consider it preferable to the "spur" system, so called, recommended by some writers. In providing bearing wood for the succeeding year, it should be borne in mind that canes springing directly from the root do not bear the first year, but canes springing from old wood, or wood of one year's growth and upwards, are only to be relied on. There is no such thing as laying down rules which would be applicable in all cases. Proper pruning is best learned by practical experience and observation. Let a new beginner exercise his best judgment, and then observe the result. If he should err, he will soon discover in what respect he has erred, and will correct this and try again. By pursuing this course he will in a very few years be able to act understandingly at least. It may be said that the pruning may be left to experienced vine-dressers. This is not always practicable, but even if it were, it is not a course to be recommended in all cases. We have found experienced vine-dressers to differ from us *in toto*, and to prune in a manner which we would not allow under any considerations. A few years since

a very worthy gentleman, of great experience in the business, going through one of the vineyards on the island, protested in the strongest terms against the manner in which the vines were pruned, and against the management generally. It was, he said, at variance with his experience during a long life spent in a vineyard, and that if he should manage so badly he should not expect any adequate return for his labor. It was suggested to him that perhaps the conditions might be different; that the same treatment of the vine which would be wholly inapplicable when he had acquired his experience might answer here very well. He remarked that it was all "wrong *anyhow*, and that Almighty God for some wise purpose allows your grapes to grow, notwithstanding your bad management, and that is all I have to say about it!" This was, of course, *conclusive*, and ended the discussion.

SUMMER PRUNING.

The experience of the writer is adverse to close summer pruning. All useless sprouts may be cut away entirely, but the bearing wood and the wood designed for bearing next year should be interfered with as little as may be. If they grow so long as to be in the way of getting about, they may be shortened in, but further than this should not be disturbed. It is possible to prune too much as well as not enough. Too much pruning in summer is almost sure to force out the fruit buds of the succeeding year. Especially is this the case with the Isabella. It is quite common to see fruit setting in August which should have lain dormant until the next April.

After the fourth year the vineyard may be considered as established, and with proper management may be expected to continue in good bearing for a long time—a century or more, for aught we know. I have Germans in my employ who say they were born and brought up on the same vineyard as their fathers before them, and that they can see no difference in the vineyard or any signs of deterioration during a lifetime, and that their fathers tell them the same story. In my own vineyard, to a casual observer, there is no perceptible difference between the vines eighteen years old and those which have just come into bearing. A closer examination will show near the surface the stumps of vines which have been cut away, as recommended in what we call the "renewal" system. This system of pruning leaves the vineyard always young; no stumps or main stalks more than three-fourths of an inch in diameter, and, as a necessary result, the fruit is always nearer the ground than when a large main stalk is left, as in the "spur" system of pruning. It is generally conceded that fruit grown near the surface of the ground is richer in sugar and ripens somewhat earlier than that which is five or six feet high up. This is attributed to the radiation of heat from the surface of the earth. This is by no means improbable, since we know that a thermometer suspended within eighteen inches of the bare earth in a hot, clear day in summer will indicate a higher degree of temperature than one suspended six feet above a surface covered with vegetation.

I have said nothing about manure in the preparation of land for a vineyard, for the reason that in this locality it would be considered not only useless but a damage to the crop.

The vines might be stimulated to a greater growth, but this would be quite unnecessary, and perhaps, also, the size of the individual grapes might be somewhat augmented, but this would be at the expense of their value for wine as being more watery, and containing a less percentage of sugar.

In the foregoing remarks the writer has aimed at nothing more than a plain statement of results which have been arrived at after years of patient study and observation. It is not, by any means, claimed that we have yet arrived at perfection. Much is yet to be learned; we have a field before us, and stimulated by the success which has thus far crowned our labors, we feel encouraged to go on with renewed energy.

EXPERIMENTS ON GRAPE CUTTINGS RECEIVED FROM THE PATENT OFFICE.

BY S. J. PARKER, ITHACA, NEW YORK.

I HAVE received eight or nine kinds of grapes from the office, only one of which I have lost—a Hungarian variety which never sprouted. My other Hungarian grew less and less stout, until last winter it died to the surface of the ground, as did some northern varieties during this hard winter, (1860–'61.) This I now have under glass, (grapery,) and it promises, as well as the two El Pasos, to fruit the coming season.

My two "*Delawares*" grew well, but made very slender wood. I have bedded several vines from them also. This county has at least 8,000 Delaware vines, and it was reckoned 10,000 more would be propagated the current season.

The "*Waxatawny*" grew rapidly, made heavy wood, and promises well. It was a very feeble plant when received from the office.

The "*Red River*" also grew large, thrifty, and ripened its wood perfectly.

The "*Henshaw*" has grown less, is feeble, but is so well protected that I shall not lose it.

The "*To-Kalon*" would have died had I not renewed its roots by a hot water tank heat of a first class propagating house. Of course, as yet, it is feeble.

The "*Lincoln Downer*" has grown well.

The *Dracut Amber* did well also, yet grew less rank than the Waxatawny, or Red River.

The *Jonathan* grew well and ripened its wood well.

These are all I have received from the office. From them I have distributed cuttings and rooted plants to others.

I have herewith sent to the Patent Office cuttings of the "Rocky Mountain seedlings." The vine from which I sent, a year or two ago, cuttings to the office is not as good as the vine from which I now send. This variety ripens early, is hardy, of a light amber color, and is esteemed by two or three who have large vines of it. It is from a vine given to my uncle, Mr. Chesterford, and Mr. Roper, both of Danby, New York, who put out a vine (a layer) here in Ithaca, and two in Danby, the original and a layer, on a hill, six miles south of this, where the Isabella will not ripen at all.

Two other seedlings, from the seeds gathered by my father beyond the Rocky mountains, were given to an old gardener in the north part of this town. One of them is believed to stand on the land of Mr. Van Order, who considers it the best he has, and it is a valuable variety, in my opinion. The other vine stands near Mr. Van Orden's. Both vines are nearly alike, *perfectly hardy, ripening early every year*, darkish amber, small compact bunches, sweet, pleasant; keeps long either on the vines or in the house. The vines now in the possession of the Patent Office, from the cuttings I sent, have the fault that the fall variety from the bunch is more harsh, and the berries are smaller; the cuttings now sent have none of these faults. These vines I have observed closely last year, as they all fruited.

The *Spencer* or *Wells's White*, that, during the last year, I promised to send the office, I cannot send, for, though I have it, the owners are unwilling to have it sent. It is, in my opinion, a very valuable *white grape*, an accidental cross of a *Sweetwater* and an *Isabella*. That it bore, unprotected, the unusual winter of 1860–'61, as well as some six other previous winters, prove it to be

hardy. I have traced out another seedling—a cross of an Isabella and a Chaselas Masque, as both vines grew intertwined on the same trellis. The Isabella unprotected, and the Chaselas covered in winter. The Isabella now stands in the garden of the lady who planted the seed. The other vine is gone. It may have been a Gray Frontignac, instead of a Chaselas. It was a tender, light flavored grape. This tender vine bore only two years and died. The lady planted all seeds of choice bunches of grapes in a flower bed. This vine came up and has borne four years a *delicious white grape, clear, transparent, and early.* The leaf, to my eye, is like an Isabella, and unlike any foreign vine. It is less hardy than the Spencer or Wells's grape, yet is a hardy out-door variety here. Flean calls it the *White Isabella*, as it mostly resembles the Isabella in the habits and hardiness of that vine. If it proves a new and valuable kind after ten years' trial, I shall expect the Patent Office to pay me, for the cuttings now sent, a sufficient compensation for its value. For I believe it more valuable than any other kind I have, some thirty varieties; far more so than the Delaware, for it is superior to that in size, flavor, and beauty, and as hardy and as early.

If the *Blue Tart* (Oporto and Blue Vine grape) are of any value, I can let the office have cuttings in abundance. Of these I have made cream of tartar the last fall. The stems and the skins from the first, when boiled in water an hour or two, become so highly charged with cream of tartar that the crystals freely deposit from the water in which they were boiled. For wine and cream of tartar these "blue seedlings," as I believe of the Isabella, of which there are a dozen sub-varieties here, are valuable, though too tart to be eatable grapes.

I very respectfully request the favor of other varieties of grapes from the office, especially the *Clara, Washita, Seedless, Egyptian*, and the more hardy out-door Hungarian grapes. Most of the grapes of foreign kinds I have now. The under glass Hungarian would be of less value than the hardy out-door grapes.

I send what I received from Boston as *Hungarian White Tokay.* It is the largest, most showy white grape we have under glass, but is at this place inferior in flavor. Of the kind mentioned in the report of 1860, I request the *Sage grape, Bartlett, Raabe, Franklin, Woodford, Emily, Clara, Anna, Louisa, Canby's August*, and other valuable kinds at the disposal of the office. The *Black Morocco, Black Muscat of Alexandria, Bow-wood Muscat, Black Dowasen*, and the *Wilmot Hamburg* would be acceptable for culture under glass. I have two Wilmot Hamburgs, but neither is very sweet, and they show more of the "hammered appearance" of the berry.

The vintage of 1861 was less than the year before at this place. In 1860 about 7,000 gallons of wine were made, but this year only some 1,500 gallons. This was owing to the quantity of fruit being less than usual after the remarkably hard winter, and to the unusually late or rather long fall of mild weather. The grapes ripened so well as to be in great demand for table use, for which use most of the crop (amounting to some tons) was sold at five to fifteen cents per pound, in small quantities at the highest figure. One large vineyard sold some three tons in the vineyard at five cents. Our wine of 1860 has ripened so far better than the last large vintage of 1858. It makes a very fine Isabella Hock, that is, a light lemon yellow, slightly rough wine. Some of it is light lemon, slightly tinged with violet. Evidently we are improving in our vines. When I speak of grapes ripening here, it ought to be remembered that only a few thousand acres in this country are fit for any kind of grapes. As a rule, all land over 300 feet above the level of Cayuga lake (which is forty miles long and one to four miles broad) cannot ripen any kind of grape successfully. So all lands, even in sheltered valleys six miles from the lake, are useless for the grape. This reduces the grape land to a mere fraction of the land in this vicinity, while it leaves land enough for a million or two

of dollars capital to be expended. Our investments yet are small, though so far very remunerative. But what should be guarded against is, that, because the Cayuga valley, the Crooked Lake valley at Hammondsport, and other favored spots, are suited to the grape, therefore either the Patent Office or any other influential source believe that the broad State of New York is all grape land. No error could be greater. I can point to a fruitless vineyard within less than half a mile of my house, the mere elevation being too great. Land south of this is not as good as that about here, and much of it utterly impracticable. All I can say or do say to my numerous friends and correspondents is, that, if here a difference of one hundred feet in the elevation may change all, or half a mile of distance, either way may be fatal, then be cautious how you plant vines; because a fine house, a comfortable home, and a fine farm of a strict cultivator may be the better if a small vineyard be near it, it by no means follows that the desired vineyard can be had, or the grapes ripen out of doors at the wish of my friend or correspondent. Could you suitably remark on this in your course of report I should be glad. The planters and farmers of doubtful lands should be advised to confine their vines to a low trellis, not over four feet high, and on such trellis not allow the vines to ramble, but strictly and heavily prune them. At least such training on lands where it is hard to raise grapes will be more apt to give them fair and ripe.

It is important to know, also, the time necessary to cultivate before the vine bears. Many cultivate thus: They buy a dozen or 100 two or three years old vines. They get a large vine the second or third year. It is expected to bear well. But at the point of their hope the vines fruit poorly or even not at all. And then they seal the fate of their vines by neglect, and make up their minds that their lands or vines are at fault.

On the other hand, with the best of cultivation in the most favored spots, if, in three years a little fruit is obtained, and the vines do not bear freely till the sixth or eighth year, the locality is a good one. If ten years pass away before a full crop is obtained, even yet the locality may be not the best, but can be made to raise grapes. So of new varieties. It may take ten or fifteen years to prove any one of them, and the cultivator must not be disappointed if he gets only an old variety under a new name. We are slowly working out the vine and grape problems of the Atlantic slope of the continent; and so far the results and prospects are exceedingly flattering.

THE GRAPES OF NORTH AMERICA.

BY S. B. BUCKLEY.

ALTHOUGH much has been published about the indigenous grapes of North America, still they are far from being well known, and botanists are not agreed as to the names which should be given to the different species. The descriptions of them by the older botanists were so brief that it is often impossible to tell the particular species intended to be described. To increase the difficulty, mere varieties of one species were sometimes described and made into two or more species. The writer has paid particular attention to them during many years of extensive travel for the purpose of acquiring a knowledge of the botany of the country, especially its trees and grapes, neither of which can be well understood without an extensive observation of them in their growing condition.

The grapes are so varied in the shape of their leaves that it is difficult for the closest botanist to distinguish their species from mere specimens in the herbarium. The same vine often has entire leaves, and also those which are deeply lobed with many intermediate forms. The fruit, which is one of the most characteristic marks of species, is frequently wanting in the herbarium, or, if there, in its dry state it has nearly lost all its distinguishing characters.

There are but five native species of the *true grape* growing east of the Mississippi river which are known and recognized as such by the best botanists. These are, the Northern Fox grape, (*Vitis labrusca* of Linnæus;) the Carribean grape, (*Vitis Carribæa* of De Candolle;) the Frost, or Summer grape, (*Vitis æstivalis* of Michaux;) and the Muscadine, Bullace, or Scuppernong grape, (*Vitis rotundifolia* of Michaux.) All other species which have been described or named, and said to be indigenous east of the Mississippi, are varieties or forms of some one or other of the above.

In addition to those five species of grape, there are four which are peculiar to Texas, of which three are now first described. The California grape (*Vitis Californica* of Bentham) completes the list of species of grape which are known to be natives of North America north of Mexico, making, in all, ten species of the *true grape.*

Texas is emphatically the land of the grape. In some portions of this great State vines climb over almost every tree and bush. It has every variety of soil and climate—lands of the greatest fertility and barren sands. More than one-half of its soil is subject to long droughts, which often blasts the hopes of thousands cultivating corn and cotton. This peculiarity of climate gives a somewhat peculiar vegetation, growing many trees and plants which have recently been described or remain to be described by botanists. There is a great similarity between the climate of Texas and that of Palestine, which has ever been noted for its large clusters of grapes; and although the clusters of Texas grapes are much inferior in size, still, in largeness of berry they will compare favorably with those of Palestine or any other part of the world.

Nearly two years of almost continuous travel in Texas, as botanist of the State Geological and Natural History Survey, brought to my frequent notice three new species of grape which promise to be a valuable addition to the cultivated vines of our country.

The American grapes are now receiving great attention in the vine-growing regions of Europe, especially France, where American grapes are being introduced with the hope that they will be free from the disease which attacks and sometimes destroys the European vine. The European wine-makers also are beginning to fear that America will manufacture wine sufficient for its own consumption.

That this country is destined to vie with Europe in the manufacture of wine successful experiments made in grape culture amply prove. Both north and south, east and west, in far distant sections, excellent wine has been made and good grapes raised. The cultivation of the grape has been very profitable to every one who has *understandingly engaged and continued* in the business. Everybody loves to make money, and this proves beyond question that American wine will be common and American grapes abundant. There is no danger of overstocking the market, because the demand for both grapes and American wine increases faster than the supply.

Mr. McKay, at Naples, in western New York, has realized during many successive years from $1,000 to $1,200 annually from the sale of grapes growing on one acre. His annual expenses for cultivation and marketing are from $200 to $300.

A gentleman at Camden, in Wilcox county, Alabama, from an acre of Catawba grapes in one year (1858) made 400 gallons of wine, most of which he put into quart bottles, and sold at one dollar each to the neighboring planters, the de-

mand from whom, even at that price, was much greater than the supply. In the fall of 1859 I saw his vineyard, which looked remarkably thriving, and also tasted his wine, which was excellent.

Professor Swallow, in an interesting article on grape culture, published in the Transactions of the Academy of Natural Science, at St. Louis, 1861, p. 163, says that the cost of vineyards in Missouri—preparing the soil, setting, and training the vines until they come into bearing—varies from $200 to $300 per acre. The annual expense for after-culture is from $50 to $60 per acre; to which add ten per cent. interest on first cost, say $20 to $30 more per acre, and we have the total expense for each year equal to from $70 to $90 per acre, or, at most, $100 per annum will pay interest on first cost and expense of cultivation.

The Missouri vineyards yielded an average of 250 gallons of wine per acre in 1849, the average price for which per gallon was $1 60, making an annual income of $400 per acre, and a profit of $300. The profits of successful cultivators have been much greater. Mr. Pœschal, of Herman, is said to have made over 400 gallons per acre, and an annual profit of more than $500 per acre for the last ten years.

The Scuppernong has lately excited much attention, and is now much cultivated in the eastern portion of North Carolina for the manufacture of wine. Its grapes have a thick, tough skin, of a green color, dotted with rusty specks. Its pulp is soft, sweet, and juicy. It is said that brandy or whiskey in small quantities is generally added to prevent its wine from souring. Certainly its wine is first rate, and it is thought by many to be superior to any other American wine. When in North Carolina, I was told by some cultivators of the Scuppernong that their grape did not succeed and bear well in the interior, away from the seaboard. Whether this be true or not I cannot tell, but certainly the Scuppernong is little cultivated in the interior of any southern State. A Mr. Brown, at Natchez, Mississippi, showed me a Scuppernong vine which completely covered a long arbor shading a walk in his garden; at the same time he remarked that the vine was of little value except for shade, as it seldom bore fruit.

The cultivation of the European grape (*Vitis vinifera*) has generally proved a failure in this country. It has been repeatedly tried and its culture as often abandoned by the Germans, Swiss, and French, who were skilled in the management of the vine in their native lands. To test the matter fully a Frenchman named Lakanel, an old member of the French convention, tried its cultivation in Ohio, Kentucky, Tennessee, and Alabama. He did not succeed in either place; he returned to France, and reported the result of his experiments. I remember to have seen very large stems, at least eight inches in diameter, of the Black Hamburg, growing in the open air in the old garden formerly owned by Herbemont, at Columbia, in South Carolina. These vines were healthy in 1858, and the proprietor of the garden assured me that they bore an abundance of fine fruit. They were planted by the elder Herbemont, and are at least thirty or forty years old. The European vine also does well at El Paso, and in several of the Mexican States, where it yields both wine and raisins. The El Paso grape is cultivated to a considerable extent in western Texas. Thus it will be seen that the European vine is a positive failure in nearly every portion of the United States, and this gives additional importance to our native vines which are the sources to which we must look for good grapes and good wine.

The European grape (*V. vinifera*) is a native of all the lower regions of the Caucasian chain of mountains at the north, and is still more common at the south of the chain in Armenia, and also along the south shore of the Caspian sea. From these regions its cultivation began anciently in Asia Minor, and was extended into wine-producing lands, where now its varieties are very numerous. The younger De Candolle relates that there are (1853) about 400 varieties of

it in the botanical garden at Geneva, in Switzerland; and further, that from observations made by his father and himself, it is known that none of these varieties have changed in the character of their fruit, or its time of ripening during a period of twenty-five years, always excepting the variations arising from different seasons—wet or dry, cold or warm. The Count Odart made like observations upon his numerous collection of vines, and he affirms that thirty years have not altered his varieties. This is important, because it proves that grapes rarely, if ever, hybridize, and it only gives the botanist confidence in species, for he knows that they are not undergoing continual changes by hybridization. There is always a tendency in the grapes growing from the seed of a variety to assume the normal form, or go back to the original stock. The exceptions are very few, and these *exceptions* form our present varieties. It is well known to cultivators who sow seed for the purpose of obtaining new forms, that very few of the plants thus grown prove to be excellent—it may be none, or one in a hundred or a thousand. This one is preserved and multiplied by cuttings, and a permanent variety is made, not remaining permanent if propagated by its seeds, but only when propagated from its cuttings.

All the American grapes, when uncultivated, are diœcious, or diœco-polygamous—that is, they have male and female flowers on different plants, or else both sexes on the same stem. This is why some grape vines seen in the woods are barren.

The most permanent and reliable marks of a species in the grape are its racemes and fruit. All the species have similar flowers which are more or less sweet-scented, especially the male flowers; but the racemes and fruit are unlike in the different species. A tree is known by its fruit; so is a grape.

I am indebted to Mr. Durand, the able botanist of the Academy of Natural Sciences in Philadelphia, for valuable information embodied in this paper. At the request of some of his friends in France, interested in grape culture, he is preparing a monograph of the North American grapes for publication in the French language.

No. 1. Fox grape of the northern States, *Vitis labrusca*, (Linnæus.)—Leaves broadly cordate, entire or rarely 3–5-lobed; lobes acute; toothed; teeth slightly mucronate, under side of leaves, petioles, flowering racemes, and young branches coated with a ferruginous down. Racemes few-flowered, fruit large, bluish black, in some rare instances of a pale green or amber color; noted for its tough skin and a musty foxy taste—whence the name. Grows as far north as the southern portion of Upper Canada, and in all the Atlantic States to Florida. According to Torrey and Gray, it is also a native of Texas. It is the parent of the Isabella, Catawba, and several other esteemed varieties in cultivation. Its fruit is large, from one-half to three-fourths of an inch in diameter, and it varies much in taste, some forms being tough and unpalatable, and others agreeable. It is ripe in August and September; stem climbs high. The common names given to this species and *æstivalis* and *V. cordifolia* are not uniformly constant. All three are called in different sections "Frost grape" and "Fox grape," and both *æstivalis* and *cordifolia* are often named "Frost grape" and "Chicken grape" in the middle States. At the south they are likewise confounded by these common names. The three may thus be distinguished. The true Fox grape has short and almost simple racemes, large fruit with a tough skin and pulp, having the peculiar taste mentioned above. The Frost grape has long, compound racemes, with a smaller thinner skin, and fruit more acid, generally closely placed on its divided and branching racemes or panicles. The Winter grape (*V. cordifolia*) has smoother leaves than either of the preceding racemes, long, but not as compound as the *æstivalis*, nor is its fruit as large nor as closely packed on the panicles.

Emerson, in his description of the trees and shrubs of Massachusetts, mentions a summer white or early white variety of Fox grape which has some peculiarities, having leaves on long petioles, bristly and downy, with a rusty down covering closely the under side of the leaves. Fruit two-thirds to three-quarters of an inch in diameter, pale green, or of the translucent color of the Malaga grape when just ripe. It ripens the last of July and first of August. He gathered some of this variety in the woods, which he thought decidedly superior to either the Isabella or Catawba.

No. 2. "FROST GRAPE," "CHICKEN GRAPE," *Vitis æstivalis*, (Michaux.)—Leaves broad, cordate, entire, or 3–5-lobed; lobes acute, unequally toothed; teeth acute, under surface coated with a rusty woolly pubescence, as are also the petioles and young branches; racemes long, compound; fruit about half an inch in diameter; ripe in October. This vine is often confounded with the preceding, to which it has a general resemblance. Yet it is easily distinguished from *V. labrusca* by its longer and more compound racemes and smaller fruit, which has a thinner skin and a more acid and tender pulp, which, when fully ripe, is often pleasant to the taste. Its leaves are also more deeply and variously lobed than those of the Fox grape. I have never heard it called "Summer grape" by those who are not botanists, hence the specific name of Michaux is ill-chosen; and he was, probably, misinformed as to the time of its ripening fruit. Like the "Fox grape," it climbs high, and frequently spreads itself over a large tree. Its range is with the preceding, and further west. According to Torrey and Gray, it extends through Texas into New Mexico. It is common in all the Atlantic States, excepting, perhaps, Maine.

No 3. "MUSTANG GRAPE," *Vitis mustangensis*, (new species.)—Leaves cordate, entire, rarely 3–5-lobed, sparingly sinuate at the base, margins entire, or coarsely and bluntly toothed, teeth obtuse, upper surface of leaves rather smooth, dark green, beneath coated with a dense white, woolly down, which also nearly covers the young branches, petioles, peduncles, and pedicels; racemes compound, shorter than the leaves; berries large, black or dark purple, thin skin, beneath which is a cuticle containing a red and very acrid juice. The true pulp is edible, and not unpleasant. It varies in color from red to white. Ripens first of July. Fruit four-seeded. Flowers last of March and first of April. The Mustang grape abounds in rich soils throughout a large portion of Texas, but it is most abundant in the woodlands along the banks of streams and rivers, climbing both low and high; sometimes with its dense foliage killing the tree which supports it. The upper surface of its leaves are of a deep green, somewhat glossy, as if varnished, which is often contrasted by having a white spider-web-like down along the midrib and veins. It is the largest vine growing in Texas. I measured one in Navarro county which was eight inches in diameter at three feet from the ground, and it maintained the same diameter many feet upward, ascending about eighty feet, and at the height of sixty feet expanding and covering the top of a large tree. It is dicœcious as well as polygamous; hence male or infertile vines are often seen. It is important in getting cuttings to obtain them from bearing, or, better, from both male and female plants. It bears profusely, having short clusters filled closely with very large berries, which are about three-fourths of an inch in diameter. I measured several which were nearly an inch in diameter. It is often eaten by squeezing the pulp carefully out of the skin, to free it from the inner pellicle, containing the acrid juice mentioned above, which, if swallowed, gives a burning pain in the throat, which is followed by a soreness if the dose be large. The Mustang is not a good table grape, but promises to be of great value for wine. Mr. Thomas Affleck, who resides near Brenham, in Washington county, showed me a Mustang vine on his grounds covering a large live-oak tree, from which, in one year, he gathered grapes sufficient to make two barrels of wine. Dr. Gideon Lincecom,

of Long Point, in the same county, from a vine eight years old, growing in his garden, in one season made fifty-four gallons of wine. Mustang wine is made in Texas by gathering the grapes in July, and passing them through a cog or cane-mill, or else they are placed in a cask open at one end and pounded. The juice is then put into casks, leaving the bunghole open to permit free fermentation, which is said to carry off all impurities. After this it is fit for use by adding from one to three pounds of sugar to the gallon to suit the taste. The wine is excellent, of a deep red color, and with about one and a half pound of sugar to the gallon resembles some clarets. I prefer it to any wine made from the Catawba, Isabella, or Scuppernong, and I have often heard others well tasted in American wines express the same opinion. The Mustang has been little cultivated, and when placed in the garden receives little or no pruning. In most parts of the south there is more or less flow of sap during every month of the year; hence it is questionable whether any grapes will thrive with close pruning in that climate, since it is well known that to cut off limbs of the vine when the sap flows freely is injurious. They, as it were, bleed too much, and lose a portion of their vitality.

No. 4. CARIBBEAN GRAPE, *Vitis Caribæa*, (De Candolle.)—Leaves round, cordate, acuminate, repandly toothed; teeth mucronate, entire, rarely slightly 3-lobed; lobes acute; an arachnoid, rusty-colored down on the lower surface of the leaves, and also on the petioles, pedicels, and young branches; racemes long, compound, as long or longer than the leaves; fruit dark-purple or black; climbs high.* The Caribbean grape grows in moist thickets in Florida, whence it is occasionally seen along the shores of the Gulf of Mexico as far as southern Texas. It was found in Arkansas by Nuttall. Its grapes are small, sour, and generally unpalatable, yet sometimes it has fruit agreeably acrid. It is little known, and seems to be of little value to cultivators. Its vines are said to be so full of juice that they are sometimes used in the arid regions of the West Indies to allay thirst. Its leaves are smaller than those of either of the preceding. Its fruit and racemes show that it is nearly related to the *V. æstivalis*

No. 5. *Vitis Californica*, (Bentham.)—Leaves sub-rotund, sub-acute, large toothed, entire, or 3–5-lobed; cordate at the base, smooth above; arachnoid, tomentose beneath; leaves broader than those of the Caribbean grape, never acuminate, and they also have a deeper and more narrow sinus at the base; grapes small, black; grows along streams in the valley of the Sacramento, California. The following is from the Pacific Railroad Report, vol. V., p. 39, of the article Geology, giving a notice of the Tejon valley, in California: "It is probable that grapes could be cultivated in this valley with success. The borders of the creek were overgrown in many places by thick masses of grape vines, loaded with long and heavy clusters of fruit. This grape is deserving of attention, as it is probable that it will be found an exceedingly valuable variety for the manufacture of wine. The berry is small and round, and much resembles the ordinary Frost grape of New England, but it is larger, more juicy, and rich in flavor, and also has a high color, yielding a juice of a rich claret color."

No. 6. "WINTER GRAPE," or "FOX GRAPE" at the south, *Vitis cordifolia*, (Michaux.)—Leaves cordate, acuminate, entire or 3-lobed, equally or unequally toothed; teeth mucronate; under side of leaves and also the petioles and young branches somewhat pubescent or smooth; racemes long, compound, and loosely many-flowered; grapes small, thin-skinned, and acid; ripens October and November; a variety, *V. riparia*, (Michaux,) has its leaves more unequally toothed; teeth large and acute; leaves sometimes 3–5-lobed; lobes acute; fruit like the true *V. cordifolia*. The Winter grape grows in all of the States east of Mississippi river, from which it extends westward to the

Rocky mountains. It was found by Dr. Richardson on the south shore of Lake Winnipeg, in latitude 52°. It is the only known indigenous grape in Wisconsin and Minnesota. It is the most common grape in the southern States, and, next to the Mustang in abundance, it prevails throughout Texas. It abounds most in thickets, along streams, but in Texas it is often met climbing over bushes and low trees on dry hill-sides, where it seldom rains in the summer time. It is a moderate bearer of fruit, having long and very compound racemes of small, black, thin-skinned berries, which are acid and quite palatable. Its grapes are seldom more than half an inch in diameter. Some Texas specimens which I collected in midsummer have the stems, petioles, pedicels, and tendrils partly coated with a woolly arachnoid down.

The variety *V. riparia*, which I was at first disposed to consider a good species, I found at several places along the Trinity river, in Texas. It grows on the banks of rivers and in swamps throughout the southern States, and is also common on the banks of the Schuylkill, near Philadelphia. It is a shy bearer, having only a few scattered black berries on its long panicles. Fruit in size and taste not different from the Winter grape. The Winter grape is frequently a high climber, and its stems are among the largest, if not the very largest, in the United States. I measured one near Dayton Hall, about twelve miles from Charleston, South Carolina, which was two feet eight inches in circumference at three feet from the ground, with nearly the same diameter several feet upward. Its branches were spread over a large tree about fifty feet high.

No. 7. Muscadine, Bullace, *Vitis rotundifolia*, (Michaux.)—Leaves small, reniform, cordate, unequally toothed, teeth obtuse or acute, leaves smooth on both sides, rarely slightly pubescent; racemes small; fruit large, purple, rarely greenish white; skin tough; pulp sweet. A cultivated form is called the Scuppernong. It is distinguished from all American grapes by its woody stem, with a smooth, close bark, which in old stems is slightly furrowed. In swamps it not unfrequently sends down aerial roots which I have often seen more than six feet in length. Its most northern limit is southern Delaware, where it was found with ripe fruit in a cypress swamp by Joshua Hoopes, of Westchester, Pennsylvania. Dr. Darlington, of the same place, gave me specimens which he collected at Suffolk, in eastern Virginia. It is common throughout the southern States, and thrives well even among the mountains of North Carolina, from which it extends west through Tennessee into Arkansas. It does not grow in the dry portions of Texas, nor in that State extends further west than the vicinity of Houston. In Wilcox county, Alabama, a white-fruited variety is rarely seen. There I have also found the Muscadine, with a black and rather thin skin, with a pulp sweet and juicy, and very agreeable to the taste. From a white form the Scuppernong was derived which is now extensively cultivated in eastern North Carolina for wine-making. It does not thrive with close pruning; hence cultivators generally permit it to run at will, and one vine often covers a large area. The cultivation of the Scuppernong at the north has been a failure, either from mismanagement or climate. In the mountains of North Carolina the thermometer has been as low as 12° below zero without injuring the Muscadine; hence, if plants or cuttings from there were planted in the latitude of Philadelphia, they would probably thrive, and if the Scuppernong were grafted on such, it might do well as far north as Pennsylvania. I have preferred the name of Michaux for the Muscadine, because the *V. vulpina* of Linnæus has such a short description that it will not enable a botanist to identify any particular species. The description of *V. vulpina*, as given by Linnæus, is translated thus: "Leaves cordate, somewhat 3-lobed; sharply toothed; smooth on both sides." This describes some forms of the "Winter grape," or "Fox grape" (*V. cordifolia*) of the south better than the Muscadine, which rarely has lobed leaves, nor is the Muscadine ever called Fox grape, which Linnæus states is the common name in the southern States for his *V. vulpina*.

No. 8. *Vitis monticola*, (new species.)—Branches decumbent, 3–6 feet high; leaves entire, cordate, dentate, or crenate; teeth sub-unequal, sinuate at base, nearly smooth; young branches, petioles, and veins of the leaves sub-arachnoid, tomentose; racemes very compound; berries large, white, or amber-colored; skin thin, pulp tender, juicy, and sweet; grape from one-half to three-quarters of an inch in diameter; ripens July and August. It grows on the hills and mountains of Texas, northwest of Austin, in the counties of Bell, Burnet, and Hays, where it is a great favorite of the inhabitants of that thinly-settled region. It trails on the ground, or climbs over shrubs, and is rarely more than six feet high. Its branches are long and slender, and the young shoots, petioles, and veins of the under side of the leaves sparsely coated with a white spider-web-like tomentum. Its leaves are heart or kidney shaped, rarely slightly 3-lobed at the summit. It is rather unequally toothed with acute and mucronate teeth, or rarely with broad and round teeth. Leaves from one-half to two and a half inches long, and nearly of the same width; petioles about an inch and a half in length; racemes as long or nearly as long as the leaves; fruit closely aggregated. It is cultivated in the garden of the late General Pitts, near San Marcos, twelve miles from New Braunfels, on the Austin road. General Pitts found such fine grapes on the hills north of his house that he marked one, and in the late autumn removed it to his garden. It is called the "White or Mountain grape;" differs from *V. rupestris* in its trailing habit and long slender branches, more slender than any other American grape. Its leaves are less smooth, more entire, with the teeth of the margins smaller and more equal. It also has larger and sweeter fruit which ripens nearly a month earlier than the "Rock grape." The two are always recognized as very distinct in their native situations.

No. 9. "Rock grape," *Vitis rupestris*, (Scheele.)—Stem erect, rigid, three to four feet high; branches short; leaves small, reniform, cordate, rarely 3-lobed, incisely gash-toothed; lobes and teeth acute; mature leaves smooth on both sides; when young, the lower surface with petioles, pedicels, and young shoots sparingly arachnoid, pubescent; racemes erect, compound; grapes small, black, 2–4-seeded; ripe in August and September; flowers in May. The Rock grape grows in the rocky beds of streams which are dry in summer, or else amid the rocks near rivers and rivulets; such were the situations in which I often saw it during a tour through northwestern Texas. It rarely trails, but grows bush-like; nor do I remember to have ever seen it more than four feet high. Its fruit has a thin skin, is small, rather sour, but said to be pretty good by those who have eaten it. The bark of its stems is scaly. It has been thought by some botanists to be a variety of the Muscadine, and by others to be a form of the Winter grape, (*V. cordifolia*,) but it is very distinct from either. It has been collected by Fendler, in New Mexico, and grows in Texas only in the hilly country north and northwest of Austin. It abounds on the Pierdenales river at the ford near "Dead Man's Hole," about fifty miles northwest of the State, capital.

No. 10. "Post-oak grape," "Pine-wood grape," *Vitis Linsecomii*, (new species.)—Stems procumbent and trailing, rarely climbing four to six feet high; leaves large, reniform, cordate, entire or 5-lobed; above smooth, beneath strongly arachnoid, rusty pubescent, as are also its petioles and young shoots; lobes of leaves obtuse, crenate, dentate; teeth sub-mucronate; lobes divided by broad, round sinuses; racemes compound, shorter than the leaves; berries large, dark-purple, thin-skinned, juicy, and slightly acid; ripe first of July; grows in eastern and middle Texas and western Louisiana; flowers in May. It grows in open post-oak and pine woods, where it is easily recognized by its large leaves and low habit, trailing on the ground or over bushes. In but one instance have I seen it climbing as high as six or eight feet. In the settlements where hogs run at large it seldom matures its fruit, which grows near the ground within

reach of the hogs and turkeys, and is eaten by them before it becomes ripe; hence there are few people living in Texas who have ever tasted its ripe berries. I fortunately obtained some near Brenham, in Washington county, Texas. Its grapes are from one-half to three-fourths of an inch in diameter, and of deep purple or bluish-black color, tender and pleasant, without the musky taste peculiar to some forms of the Fox grape, (*V. labrusca.*) Its leaves are on long petioles, and larger than those of any other American grape. It is an abundant bearer, and its vines have short internodes, some of which are alternately leafless, but with clusters of grapes at every node or joint. I have measured some in which the distance between the node-bearing clusters averaged only one and a half inch. At the house of a gentleman in Navarro county, Texas, I ate some delicious preserves of this grape, and I was assured at the same time that it was the best of grapes for family use, and superior to either the Isabella or Catawba. It is cultivated by Dr. Gideon Linsecom, in whose honor I have named it, at Long Point, in Washington county, Texas, and also by Thomas Afflick, who resides near Brenham, in the same county, from either of which gentlemen cuttings can be obtained.

The genus *Cissus* of Linnæus, which is made a sub-genus of *Vitis* by leading American botanists, does not belong to the true grape. A list of the species growing in this country is appended, because they are named under *Vitis* in our botanical class-books and various other publications.

Vitis arborea (Wildenow) has bipimate smooth leaves, unequally and sharply toothed; flowers and fruit on long peduncled cymes; fruit black, 2–4-seeded, climbs high, and has thick, crowded branches, forming a dense shade. Grows throughout the southern States, and extends west to the Rocky mountains. It is cultivated and perfectly hardy in the vicinity of Philadelphia, where it forms an agreeable variety with the ampelopsis and ivy for walls. It is the *Vitis bipimata*, Torrey and Gray, Wildenow's name, being the oldest, should be restored.

Vitis indivisa (Wildenow) has entire heart-shaped leaves, and fruit on long forking peduncles. In general appearance it resembles a true grape. Grows in Virginia, Kentucky, southern Ohio, and throughout the south to Texas.

Vitis acida (Linnæus) grows at Key West, in Florida, and resembles the next described variety.

Vitis incisa (Nuttall) has smooth, thick, trifoliate leaves and a climbing wasty stem. When touched it emits an unpleasant odor. Arkansas, and is also common in Texas.

GRAPE CULTURE.

BY DR. GEORGE PEPPER NORRIS, WILMINGTON, DELAWARE.

THE culture of the grape vine has received much attention throughout the middle and eastern States during the past year; the foreign varieties, or those which only can be successfully grown under glass, have especially been brought forward; this is, in a great measure, due to the public becoming aware of the simplicity with which houses necessary to the successful growing of the European varieties can be managed. Grape culture under glass has hitherto been surrounded with so much mystery that many who are in circumstances to command

the necessary appurtenances to the successful cultivation of grapes under glass have been hitherto prevented for fear of failure. To dispel this mystery, and to

GRAPERIES OF DR. G. PEPPER NORRIS, WILMINGTON, DELAWARE.

Figure 1.

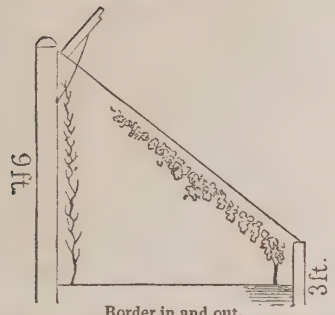
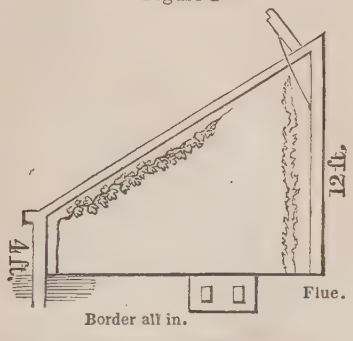


Figure 2

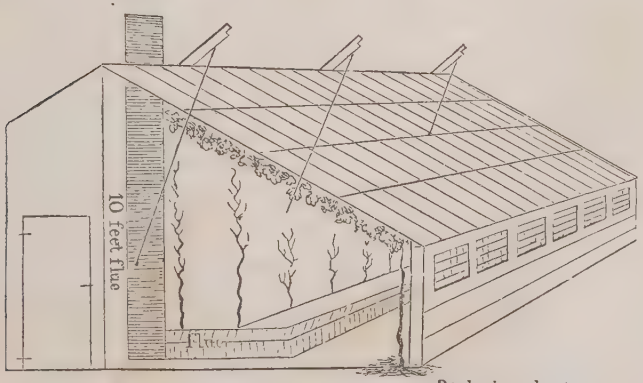


No. 1.—40 feet long by 13 feet wide; built of wood; not heated; ventilators open.
No. 2.—46 feet long by 13 feet wide; built of brick; heated with flue; ventilators open.

show with what simplicity and economy the rare luxury of a house of well-grown foreign grapes can be had will be the endeavor of the writer. It will not be within his province to discuss the various modes of propagating the vine, but, taking it for granted that the cultivator has either the necessary knowledge to obtain a stock of well-grown vines or the means to purchase the same, this communication will be devoted to showing—1. How glass houses can be constructed in the best manner and in the most economical modes. 2. How the border should be made in which the vine, with a very small share of attention, will thrive best. 3. What varieties are best calculated to give satisfaction; and

Figure 3.

GRAPERY OF DR. G. P. NORRIS.



Dimensions: 60 feet long by 13½ wide; built of stone; heated with flue.

4. Such other information as has been acquired by the author by practical experience and a familiarity with the best recent horticultural publications. A vinery may be built of frame, brick, or stone, and may vary with the tastes, inclinations, or means of the builder. An unclouded glass roof and a well-constructed border

are, however, essential for fine grapes. Vineries are generally designated as lean-to or span-roofed. The former, although not so ornamental, are to be preferred; the temperature is more at the command of the cultivator, and the best grapes are usually found in houses thus constructed. For foreign grapes, this form of house is universally recommended; and although where early grapes are not required, span-roofed houses succeed well, the partialities of the author are for the first-named shape. A lean-to vinery may be of any length; fifty feet will be found convenient when a moderate-sized house is required; the back wall may be twelve feet high, and where stone is plenty will be found most economical; a very good wall may, however, be more cheaply made, answering the purpose quite as well, of cedar posts, with tongue and grooved floor boards nailed on. The front wall should be four feet from the ground-level, two feet of which should be of glass sash, hung to the front wall plate, to be opened or shut at pleasure. The roof should have yellow pine rafters, eight feet apart, between which are placed five ash bars, on which the glass, bedded in putty and fastened with sprigs, will rest. This form of roofing has entirely superseded the old-fashioned movable sash, and for lightness, beauty, and durability

GRAPERIES OF DR. G. P. NORRIS.

Figure 4.

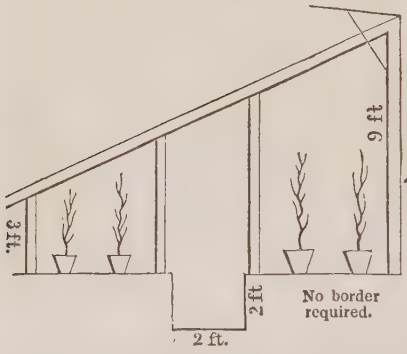
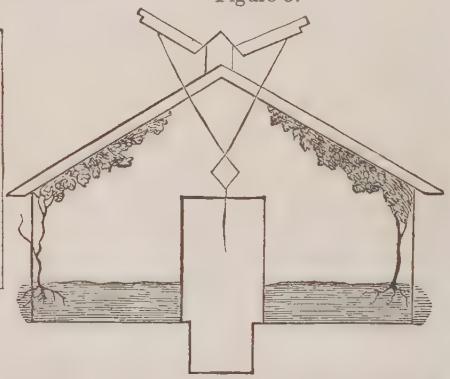


Figure 5.



No. 4.—Lean-to house for forcing vines in pots; 30 feet long, 13 feet wide; walk, 20 feet below the surface.

No. 5.—Plan for span-roofed cold vinery; 20 by 70 feet; border inside and outside.

is to be much preferred. Fourth quality glass will answer equally well as first quality, and will much diminish the cost of the building. The old-fashioned notion of the blurs in the glass causing the vines to burn has been entirely dispelled. At the top of the roof a movable sash, two feet wide, and running the entire length, will be required for ventilation. A door in either end will complete the building. The border in which the vines are to be grown should be an object of much concern to the cultivator. Borders are made either entirely outside, and the vines planted outside and brought in through the front glass sash, or are partially inside and partially outside, the vines being planted altogether within, or they are made entirely inside, and the roots prevented from getting out. These last are at present much in vogue, and for houses in which grapes are to be forced early offer inducements.

Among the advantages claimed by the entirely inside borders are the ability to keep the fruit after ripening. For the cold vinery, however, *i. e.*, the vinery without fire heat, or with only sufficient heat to prevent the early frosts, the borders partially inside and partially outside, with the vines planted inside, about two feet from the front, will be found to answer best. Whatever kind of a border may be determined on, good drainage will be found an indispensable

requisite. The grape delights in a well-drained border, and, notwithstanding what other precautions may be taken, if this is neglected the house will be a failure. Three feet may be excavated, and six inches filled up with small stones, spalls, brickbats, or such other rubbish as may be most convenient, on top of which, if they are to be had, a layer of six inches of oyster-shells may be placed. An inverted sod on the shells will prevent the border from settling among the stones. The materials for the border should be selected some time prior to the building, and suffered to mingle in a heap. The main ingredients recommended are sod from an old pasture field, thoroughly incorporated with well-rotted manure, sand, bone dust, and wood ashes. The days for burying dead animals in grape borders have, I trust, passed away, as it is understood that the grape revels in a dry, mellow border, but detests a pasty, rotten mass of putrefying flesh. The vines should be planted about the 1st of April, and two-year-old vines are to be preferred. They should be cut down within three eyes of the bottom; after starting, the strongest eye to be selected, and the other two rubbed off, and a single rod trained up. For the first season all the laterals should be suffered to grow. If the object is to attain an immediate crop of fruit, each alternate cane should only be cut down, and the standing canes will give a fair crop the next year after planting. After fruiting, they are intended to be cut down to the ground, and their neighbors kept for next season's fruiting. This is known among grape-growers as the renewal system, and has many advocates. To practice it, the vines should be planted not further than two feet apart. The main advantage of the renewal system is that of obtaining a crop in a year after building the house. It would be impossible to enter into a discussion of the relative advantages or disadvantages of any system of pruning. They will be found discussed at length in the various horticultural publications. Downing's Fruits and Fruit Trees (the article on the grape) and Charlton's Grape-grower's Guide will give the beginner all the needful information. The renewal system has been alluded to, as it has been lately presented to the public in a new form, and quite a number of houses are now worked on that principle. Of all the kinds of foreign grapes now under culture the old Black Hamburg heads the list. A free bearer, its large size and luscious flavor make it universally esteemed. It is also very hardy, and will bear more bad treatment than almost any other foreign variety. This grape should predominate in every cold vinery. The Muscat of Alexandria, thought to be the finest-flavored variety known, although often maturing without the aid of fire heat, is not to be recommended in any quantity in a cold house; with fire heat it is second to none. It is not as free a setter as the Hamburg, but its berries are larger, and it is a better keeper. For an early variety the White Frontignan has no superior, and in a house with a very dry border will rarely fail to please. The Purple or Black Frontignan is also much like its namesake, except its dark color. Black Prince is also an excellent variety for a cold house, on account of its hardiness. West St. Peter's, Black Lombardy, and Black Morocco are late grapes, and can be recommended as such. They hang long on the vines, and, with a little care, will, with fire heat, keep well until Christmas. Among the late grapes the Syrian must not be overlooked. This grape produces the largest bunches known, although not of the first quality. It is a good kind in making up a selection, and keeps well.

The Grizzly Frontignan should perhaps have had a place among the Frontignan family; it is very sweet and the husk is long. Among the new varieties which, however, are as yet insufficiently tested, are the Black Barbarossa, which for keeping is said to have no superior. Trentham Black, also fruited the first time in this country probably this autumn, is a large dark-blue grape with very rich deep bloom, a very desirable variety, as far as known, although not recommended *as yet*. Buckland Sweetwater is another new English grape which made quite a stir among the English gardeners this season.

The Bowood Muscat, which has been much praised, is said to be identical with the old Muscat of Alexandria. A bunch of this variety, *i. e.*, Muscat of Alexandria, was grown in the neighborhood of Philadelphia this season, weighing over nine pounds. This is said to be the largest bunch of this far-famed and deservedly esteemed variety that the world ever saw. Other good kinds, where a large variety is desired, are White Nice, large bunch, tolerable good keeper; Lady Doun's Seedling, (not much known;) the Casson Hall Muscat, the largest of all grapes, but sets its berries very badly; and Wilmot's Hamburg, very much like the old Black Hamburg. Hamburgs and Muscats are, however, the standards, the former without and the latter with fire heat, which should form the bulk of the selection where a satisfactory return is desired. Champion Hamburg, Victoria Hamburg, Pope's Hamburg, Mill Hill Hamburg, and Wilmot's Black Hamburg, are all varieties much resembling the old true Black Hamburg. The Golden Hamburg, a cross between the Sweetwater and Black Hamburg, is of a golden white color, and although not yet fully tested, is a new English variety of great promise. The Muscat Hamburg is also a new variety at present attracting attention; color black, bunches large, and well shouldered. It is thought that this grape will prove desirable for cold houses. Muscat of Lunelle, Tottenham Court Muscat, and Bowood Muscat, new,) all resemble the old Muscat of Alexandria. Bidwell's Seedling, a large black grape, said to be perfectly hardy out of doors, (in England,) and Ingram's Hardy Prolific Muscat, produced from a seedling black grape, fertilized with the Muscat of Alexandria, and pronounced in England the "most prolific and best setting variety of grape, and very hardy in constitution," are among the new varieties growing in the author's recently-planted house, a report of which may probably be furnished for the Patent Office Report of 1863. Under the head of new varieties will come also Santa Cruz and Calabrian Raisin, from Mr. David Fergusson, of Philadelphia, and the Zante Grape and the Grape from the Crimea, also presents, from Mr. Wm. Bright, of Philadelphia. Of these varieties the writer personally knows nothing.

The practice of planting a miscellaneous selection of new varieties, it is to be distinctly understood, is condemned altogether, and is only pursued by the writer on account of having one vinery specially devoted to this purpose, from which it is hoped valuable results will be derived. But the planting of every new variety which is announced as "giving great satisfaction abroad," whether adopted by the amateur or the commercial culturist, cannot fail but to result disadvantageously, and should only be pursued by those having the special object in view of testing the new kinds. An enumeration of these now under cultivation at the residence of the writer, near Wilmington, Delaware, may not prove uninteresting. Among them are Muscat Hamburg, Buckland's Sweetwater, Bowood Muscat, Black Barbarossa, Trentham Black, Bidwell's Seedling, Prolific Muscat, Santa Cruz, Calabrian Raisin, Zante, and the Crimea grape, and several seedlings of the author's. All the new kinds are had as soon as procurable, and an interesting report of their growth, progress, and success, may be looked for. If of them one really desirable new variety is fully deemed worthy of general recommendation the writer will be satisfied.

"Native" grapes have also claimed much attention during the past year. The number of new varieties that have proved to be entirely hardy, and the improved quality of their fruit, will have a tendency to increase out-of-door grape culture.

To develop the fullest resources of the American varieties, a border should be prepared similar to that recommended for foreign vines. Few are aware how much real pleasure and profit may be had from a well-attended trellis of native grapes. Vines grown from single eyes are to be preferred to layers, and two-year-old vines should be selected. Among the many new kinds the Delaware is probably best known. It has shown itself capable of enduring our most

severe weather without the slightest protection, and in quality is far above the Isabella. The size of the berry is altogether too small to make this variety the grape of the country, although, from its great hardiness and superior excellence of fruit, it will be satisfactory to many.

The best grape for out-of-door culture is the Concord. Hardy, a vigorous grower, it will thrive where the Delaware will fail, and in size of bunch and berry it will compare with the Black Hamburg. All growers concur in recommending this variety for general culture. Among the most promising of the new varieties is the Maxatawny, an amber-colored grape introduced from Pennsylvania. Although as yet insufficiently tested to warrant a positive recommendation, yet its vigorous and thrifty habit and its apparent hardiness induce us to believe that before long it will stand first among the list of natives. The fruit shown at the September meeting of the Pennsylvania Horticultural Society was of an amber color, medium size bunch and berry, and quality best. Pretended varieties of this grape have been and are now offered, and care should be taken to secure vines only from those who propagate from fruiting wood. The Rebecca is another new native which, although of the first quality as regards flavor, is looked upon with suspicion respecting hardiness. Taylor's Bullet is the most rampant of any of the new kinds. Persons desiring a vine for shade will select this one. Of its fruit the writer is not qualified to speak, although not believed to be of the best. El Paso, received from the Patent Office, proved to be foreign origin, and for out-door culture of no value. Henshaw and Creveling, from the same source, are making fair growth, and appear hardy. Allen's Hybrid is well spoken of among the new white grapes, and from the appearance of the vine I am disposed to put it down as promising well, although doubt exists regarding its hardiness. Brandywine, originating in this neighborhood, has proved of foreign habit and of no value. Wilmington White is a new white grape, originating at the farm of Mr. Jeffries, near Wilmington, Delaware; of undoubted hardiness and vigor; size of bunch and berry medium; quality very good. This grape was considered most difficult of propagation. With considerable trouble the writer secured a layer from the original vine, which has given him this season over five feet of well-ripened short-jointed wood.

Cuyahoga is said to be a new variety of excellent promise, but having failed last spring to receive a vine, the writer has never seen it. From report, I judge that it should have a place in every amateur's collection. Of the Catawba, Diana, (a supposed seedling of Catawba, and much resembling it,) Isabella, and Clinton, we have forborne to speak, as their general characters are too well known to render discussion needful. The Isabella and Catawba have, in the rush after novelty, been too much neglected, and, if planted in a well-prepared border and carefully pruned, will hardly ever fail to please. The Isabella is perfectly hardy with us in Delaware, but does not sustain this character in the northern States. It is, however, a good keeper, and is generally picked too soon, being much improved by hanging until after slight frost. The disposition of the Catawba to rot may be much remedied by a well-drained border. The Diana is, however, generally supplanting it. Catawba grapes (sent from Ohio) seen in Philadelphia on the 25th of November, 1861, were in as good a state of preservation as when cut from the vine.

The Clinton, of undoubted hardiness, is a very vigorous grower, and a good wine grape. It is, like the Delaware, too small. Hartford Prolific is taking the place of Isabella in States where that variety will not stand the climate. It is of undoubted hardiness, although not of the first quality. Garrigues, and the many other seedlings of Isabella, resemble that variety too much to render any description needful. Bland, or Powel, is a good small grape, although not hardy north of Philadelphia. Alvey's Lenori and Logan are believed to be hardy, although hardly tested as yet. To-Kalon and Union Village are good-

sized grapes, but without special flavor. Ontario, said to be the largest grape successful out of doors, is pronounced insipid by the Pennsylvania Horticultural Society. Anna is a sweet white grape, but the vine is among the poorest of growers. Franklin, Herbemont's Madeira, and Lucy, from the south, are wine grapes of good character. Elsinburg and Herbemont are true natives, and desirable in a general collection. Clara, Emily, and Rade are of foreign descent, and mildew badly.

Some of Mr. Rodgers's hybrids are regarded as promising. As regards a selection, the advice given in respect to foreigners will be equally applicable. Among too many new kinds let the general cultivator rely on Concord, Delaware, Isabella, Clinton, and Catawba, and disappointment will not be his lot. Leave the new varieties to the experimentalists, and especially avoid all new kinds whose reputation is unestablished except by advertisements in the journals. If care is concentrated on kinds of acknowledged merit, and some little attention to planting and pruning, a degree of success will follow the labors of the husbandman that will not only delight but astonish him. No dwelling should be without its vine. In a pecuniary point of view, the landlord should have his attention drawn to this fact: that houses with established vines, especially if some attention has been given to them, are always more easily rented and command higher rates than those without.

Pruning.—Satisfactory results cannot be expected from the cultivation of the native grape until more attention is paid to the pruning of the vine. This is so simple an affair, and withal so important, that it will amply repay the cultivator to give some attention to the matter. The great reason that native grapes so often prove unsatisfactory in their results is to be found in the neglected or unskilfully pruned vine. The vine should be pruned annually, between the months of November and February; during the growing season the vines should be tied up, as often as they may require, to stakes or to the trellis.

Suppose Figure 1 to represent the growth made by a well-treated vine the first season. When pruning time arrives cut it back to the first cut, as shown at A. The second season, allow it to grow up as before, and cut back at B. The third season, selecting the two strongest eyes, train horizontally along the trellis, as shown at *c' c'*, Figure 2; and the fourth season you have the vine with arms (as shown by Figures 3 and 4) fruiting. *a* and *a* represent the fruiting arms; while *c* and *c* represent the wood growing for fruiting next year. In the fall cut *a* and *a* com

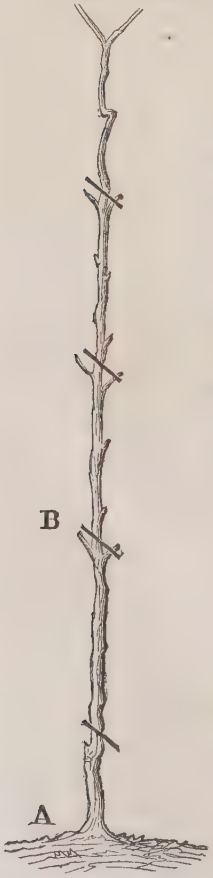


Figure 1.

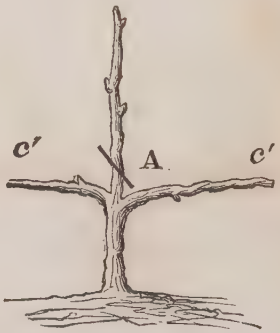
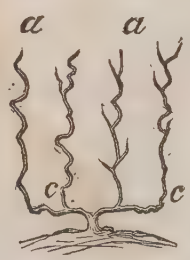


Figure 2.



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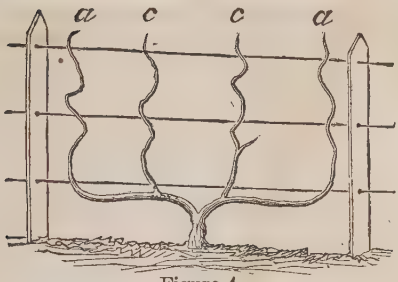

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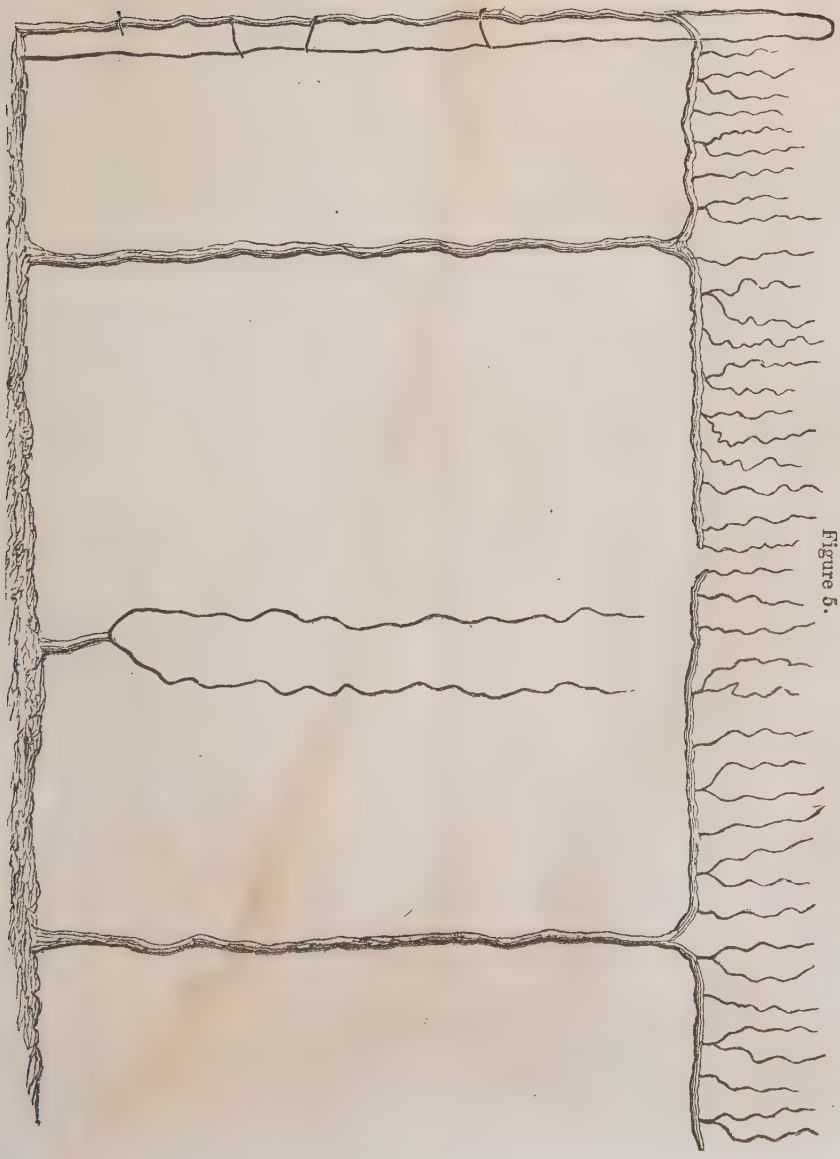


Figure 5.

pletely down, allowing *c* and *c* to fruit next season, when *c* and *c* will be cut down, and *a a* allowed to stand, and so on indefinitely. This will be found to be the

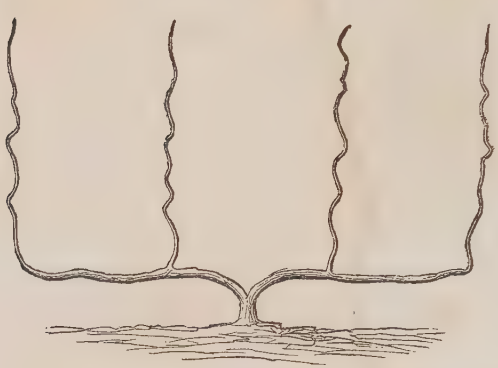


Figure 6.

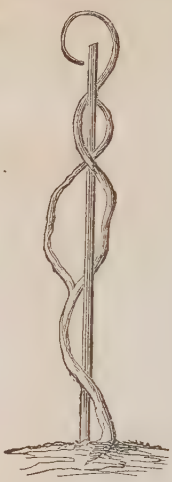


Figure 7.

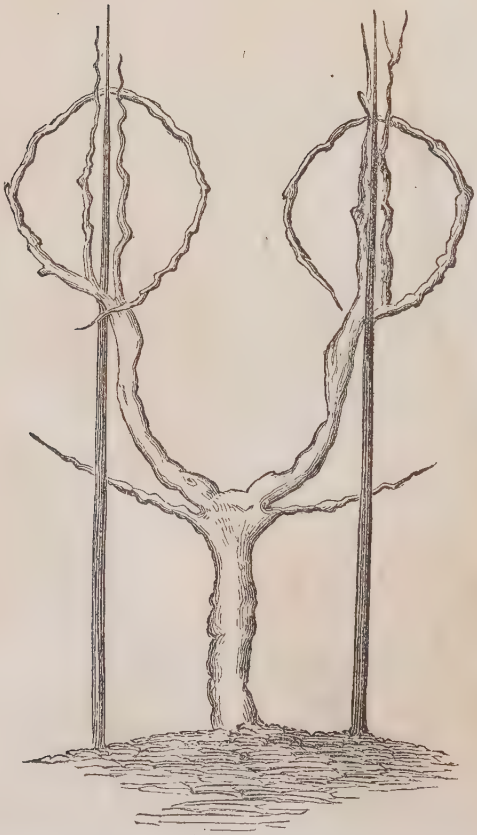


Figure 8.

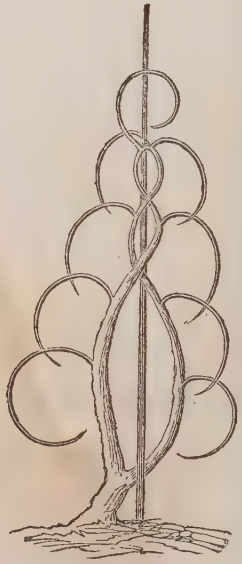


Figure 9.

simplest and best mode of pruning the native vine; it is simple and satisfactory. Figure 5 represents the system on a high trellis, and Figure 6 on a low one. Figures 7, 8, and 9 are fanciful modes of training the vines, which are much resorted to among the German vine-dressers.

REMARKS ON GRAPE CULTURE,

WITH REFERENCE TO MILDEW, BOTH ON THE NATIVE AND FOREIGN VARIETIES.

BY WILLIAM SAUNDERS, GERMANTOWN, PENNSYLVANIA.

THE culture of the grape is rapidly extending throughout the country, and gradually becoming a subject of significant importance. Within the past few years numerous seedling varieties of merit have originated, and the increased attention which has thus been diverted to this fruit has brought into prominent notice the superior qualities of some of the oldest cultivated varieties; and the spirit of inquiry and investigation that has in consequence been concentrated upon the subject has not only brought to light the most approved modes of cultivation and general management, but also directed personal observation to the diseases and maladies by which they are attacked.

The diseases of plants, although undoubtedly a subject of great importance, has not received that attention which it eminently demands, and where the attempt has been made by mere practical observers to trace a disease to its origin we find opinions conflicting to a degree apparently irreconcilable. This may arise partly from the accommodating nature of plants, together with the almost infinite modifications of the various agents by which they are influenced, rendering it extremely improbable that any single observation can be universally correct. There is scarcely any natural phenomenon which may not be explained in various ways, according as they are traced to their primary, secondary, intermediate, or proximate causes, and, as far as it goes, each explanation may be equally correct. This explanatory latitude, however, is a source of much perplexity to the uninitiated who cannot perceive that they are all derived from the same fundamental principle.

The fundamental principles in the economy of nature are comparatively few; at the same time their combined actions lead to extensively varied results, rendering it at all times necessary to observe closely, with a clear perception of their influences, before arriving at a decision respecting the cause of any phenomena that may excite our attention. In the absence of such knowledge we may not expect to arrive at just conclusions; hence the numerous opinions that are constantly promulgated in relation to the diseases of plants are valuable or otherwise, according to the knowledge of vegetable economy possessed by those whose opinion is offered.

There are few subjects that have called forth a greater amount or a greater diversity of opinions than that of grape mildew. While one will have it to proceed exclusively from excess of moisture in the soil, another is quite as certain that it depends altogether upon the system of pruning, while a third is equally assured that it is produced by atmospheric influences. It is now very generally understood that the state of the atmosphere is the real source of the malady; at the same time it may also be surmised that both the soil and the system of

pruning, so far as they are connected with vigorous growth, will influence its ravages, but neither of these are the principal cause. Therefore it is that no course of practice founded solely upon either of these opinions will constantly prove effectual, but the proper cause once thoroughly understood, the influence proceeding from certain cultural processes, either in exciting or retarding the disease and its results, will, to the vegetable physiologist, at once become apparent.

In advancing the opinion that grape mildew is mainly the result of atmospheric influences, I do so from a conviction that my observations have been too extensive and too long continued to be mistaken, and too completely free from any preconceived hypothesis, or an ulterior object to be swayed by prejudice. A further conviction in the correctness of my views is furnished by the circumstance that a course of practice, based upon a recognition of this opinion, has proved satisfactory, and has resulted in an immunity from mildew sufficient to establish the truthfulness of the observations which led to its adoption.

VARIETIES OF MILDEW ON GRAPES.

There are two very distinct forms of mildew that attack the grapes. One, which I presume to be an oïdium, develops itself upon the under side of the foliage, and another, evidently a form of erysiphe, is seen on the upper surface. The oïdium is first observed in small spots of brownish colored down, adhering closely to the ribs of the leaves; in favorable weather it spreads rapidly, and apparently destroys the vitality of the part attacked, for it speedily communicates a tinge which becomes visible through the leaf, and when acted upon by the sun these discolored spots become crisp and dry, and ultimately produce a hole in the leaf. This appearance on the foliage is familiarly known as sun-scald, although it is hardly necessary to remark that the foliage would not be injured by sun were it not previously weakened by mildew; yet many cultivators are not aware of its origin, and will maintain that their vines are free from mildew, while they admit that the foliage is *scalded* and dying off. By the time its effects are thus visible, the mildew is usually arrested, and no traces of it can be observed; hence the fact that some cultivators exhibit so little acquaintance with the disease; and hence, also, the origin of those seemingly conflicting statements relative to the exemption of varieties of grapes from mildew. I am cognizant of several instances where gentlemen largely engaged in grape culture have strongly asserted that no mildew ever attacked their vines, while the contrary facts were staring them in the face in their denuded plants, the foliage having been destroyed by mildew. I allude to this because it may lead cultivators to investigate, and save them in the misapplication of remedies in their endeavor to subdue a disease which has not been traced to its proper source.

The erysiphe shows itself in the form of a whitish powdery substance on the upper surface of the foliage, and when allowed to spread envelopes the fruit with a web which completely checks growth. It is not so disastrous or penetrating in its ravages as the oïdium, as it may be peeled off, leaving the plant to all appearance uninjured, but it has the effect of retarding growth, and unless promptly checked neither wood nor fruit will ripen, but remain comparatively inactive to the end of the season.

ORIGIN OF MILDEW.

The general diffusion of the lower forms of fungoid vegetation, such as mildew, mould, &c., upon places favorable to their development, has given rise to the belief that they were spontaneously produced by the decomposing substances.

There are others, again, who hold the opinion that even healthy vegetation may be attacked, and that the germs of mildew may be inhaled through the stomata, or introduced into the system with the fluids absorbed by the roots

I believe, however, that the majority of naturalists have arrived at the conclusion that mildew only attacks decomposing substances; that previous to its appearance some disturbing cause adverse to healthy growth has been at work on the plant, and the partial decomposition which has originated from this unhealthy condition is seized upon by the germs of fungi, which are constantly floating in the atmosphere, ready to develop wherever favorable conditions are presented.

The designation that has been conferred upon some species of insects, that of the "scavengers of nature," has also been applied to fungi; for, like insects, they labor with the most astonishing effects in the removal of refuse and decaying substances, which, were they left upon the surface of the earth, would prove injurious encumbrances. The seeds of fungi float about in the atmosphere in countless myriads, only awaiting the presence of a soil fit for their growth. As long as there is no refuse decomposing matter to be removed they remain inactive, but as soon as any quantity of decaying matter is left exposed it is covered with seeds, which rapidly develop into fungi of various kinds.

It is, therefore, evident that, previous to the appearance of mildew, there must exist a disorganization of the vegetable tissue. We must, therefore, endeavor to discover this cause in order to suggest a remedy, and as the oïdium is most prevalent on the native, and the erysiphe on the foreign grape, we will, to a certain extent, identify them in this way in our further remarks.

NATIVE GRAPE MILDEW.

The oïdium generally presents itself on the vines immediately after rains, or a continuance of cool, damp weather, more especially if these conditions closely follow a period of dry, sultry weather. The widely different effects produced by a sudden change from one of these extremes to the other is the precursor of mildew; when a plant is surrounded by an atmosphere comparatively devoid of moisture its vegetative functions are most actively engaged in the absorption and transmission of sap to supply the demands of respiration and evaporation of the foliage and other surfaces; but when a sudden change reverses these conditions, and the plant is then surrounded by an atmosphere highly charged with moisture, no evaporation takes place, and the tissues of the plant become gorged with sap. If, in addition to this, the surface of the foliage becomes wet, either by rains or dews, it extenuates the evil, an injurious amount of moisture is concentrated in the plant, and an incipient state of decomposition is engendered, and it becomes a ready prey to mildew.

The fact that grape-vines growing in sheltered positions, such as under the eaves of buildings, and under the shelter of trees, are generally found exempt from this species of mildew, points to us the most available remedy; and the common occurrence of vines growing in trees, where they are sheltered by overhanging foliage, retaining their health, while branches from the same roots trained on an exposed trellis near by will be severely attacked by mildew, is very strong evidence that the cause is mainly atmospheric.

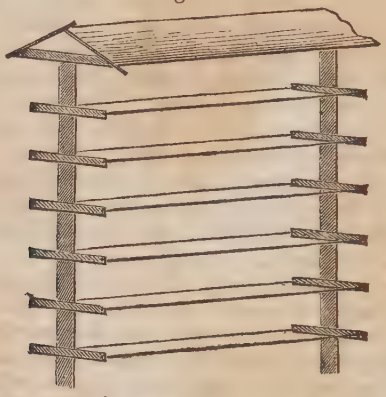
Tracing the cause of mildew to this source, it becomes a matter of inquiry how far we can employ expedients that will either prevent or modify its effects. Undoubtedly, shelter of some kind from sudden changes and atmospheric currents is one of the most prominent, and every experienced grape-grower can recall instances where even a seemingly slight protection proved of great value.

Leaving aside structural protections, which can only be of limited adoption, I consider that the most available and the most permanent shelter is formed by surrounding the vineyard with a close plantation of evergreen trees and shrubs. These would so far modify extremes of temperature as to prevent rapid exhalation of moisture during dry weather, for it is well known that sweeping currents of arid air are most injurious to vegetation, and it is now very generally understood that shelter is of great importance for orchards of the apple and pear, preventing,

as it does to an appreciable extent, the extraction of moisture, and such protection is still more important to the grape, since its broad expansive foliage presents a large evaporating surface; again, when the weather is cool and highly charged with moisture, (the conditions which favor mildew,) a sheltering screen is also of great utility. In other words, the effects are modified from either extremes, whether it be that of a clear dry or a cloudy moist atmosphere.

Having given this subject much consideration, I am convinced that a simple cover to the trellis upon which the vines are trained will materially assist in preventing the attacks of mildew. The subjoined sketch represents a portion

Figure 1.



SAUNDERS'S PROTECTING GRAPE TRELLIS.

of such trellis as I have had constructed, which will be readily understood and its advantages apparent. The double training surface which it provides will amply compensate for any additional outlay connected with its erection.

The erysiphe species of mildew is occasionally observed on some varieties of native grapes. When a vine is trained against a close fence or wall, and planted in a light shallow soil that soon parts with moisture, this mildew will frequently make its appearance during long-continued dry weather. A copious watering at the roots will arrest its progress, and, to guard against it in future, the soil should be stirred and deepened, so as to enable it to absorb and retain a sufficiency of moisture.

THE EFFECTS OF CULTURE ON MILDEW.

Soil.—The influences of culture with reference to the prevention of mildew may be briefly noticed. With regard to soil we must repeat the oft-told tale of the great necessity for thorough drainage and stirring up a proper depth of soil. This preparation guards against either a superfluity or dearth of root moisture, and places the roots in an equable medium. We have, moreover, been forced to the conclusion that it is injurious to encourage roots immediately on the surface, unless the soil is continually mulched with a loose material, which is not always practicable. I prefer to use the top five or six inches of soil as a mulching medium, which answers the same purpose in arresting the evaporation of moisture. The difficulties attending surface roots (when encouraged immediately on the surface of the soil) are their liability to sustain injury from extremes of temperature and moisture in the soil. During summer the soil is frequently perfectly parched for many inches below the surface, and plants that are dependent upon surface roots suffer severely. Again, in winter the ground becomes frozen, and the effects produced upon plants when the sap contained in their roots is in a mass of ice, and more or less evaporation continued through

the branches, is much the same as if the trees were for a time severed from their roots. This proves fatal to many plants, and is an unsuspected and altogether unrecognized cause of disease and death in trees. There are few soils that can be kept in good tilth without an occasional stirring of the surface. The best soils are most likely to *cake* during dry weather; hence it is an absolute necessity to stir the surface more or less deeply, and this loosened soil acts so far as a very effectual mulch. It admits air, which tends to prevent the exhalation of moisture. Roots should not, therefore, be encouraged to ramify in this upper stratum.

Pruning.—Systems of pruning seem to be looked upon by many as the all-important point in grape culture. Certainly it has its importance, but it as certainly has been overrated, so far as the native grape is concerned. This has in a great degree been fostered by persisting to apply the rules of culture that have gained prominence in the foreign vineyard management; and there are those who recommend the continued extraction of foliage during growth, as yet practiced by many on the foreign grape. It is true that a little experience usually tends to modify the practice, and those who would grow native grapes to any degree of perfection will find that but little summer pruning is necessary. Leaving out of the question the fact that the more foliage on a vine the greater the amount of fruit it is capable of producing, the liability of the abridgement of the foliage from mildew is sufficient to warn us to be careful in not injuriously reducing the branches during the growing season.

We have previously alluded to the exemption from mildew of vines growing in trees, and it is a matter of common remark that, when allowed to ramble at will through the branches of a growing tree, they rarely fail to produce a fine crop. It has also often been noted that branches from the same root, some of which have been rambling in a neglected fashion, without subjection to any kind of pruning, will retain their foliage entire, while other portions of the same plant, trained on an exposed trellis, will be destroyed. Instances have also frequently been recorded of vines that have been entirely neglected, so far as summer pruning is concerned, ripening a fair crop, and retaining their foliage until frost, while adjoining vines, shortened and summer pruned as laid down by some writers, have been entirely denuded of their foliage by midsummer. The reason for this unlooked-for success will be found in the circumstance that the neglected vines were furnished with such a mass of foliage that, even although a large portion of its exposed surface was acted upon and destroyed by mildew, yet a sufficient quantity was retained to perfect the crop.

It is not to be inferred from the above remarks that summer pruning is at all times unnecessary, but it points to a fact in grape culture hitherto unrecognized, at all events not acted upon—that all summer pruning performed on the native grapes weakens the plants, and renders them constitutionally as well as mechanically less able to resist those atmospheric changes predisposing to mildew.

In winter pruning the native grape the great and important rule is to retain a sufficient portion of the previous season's growth to secure a crop. All weak shoots should be entirely removed, so that the energies of growth may not be diverted in the formation of a quantity of weak shoots incapable of producing fruit, instead of one strong fruit-bearing cane, possessing enough of vigor to throw out several good bunches of fruit, and maintain a luxuriant, healthy foliage throughout the season.

It should also be prominently kept in view that winter pruning has a tendency to strengthen the plant. When a seed is planted in a medium favorable to germination it sends a shoot upwards in the air and roots downwards into the soil. The young root immediately commences to absorb nutriment from the earth, which enters into the stem, and from that to the leaves, where it is elaborated, and then returned into the stem and roots, increasing their size and formation. Thus there is a relative balance of power and a reciprocal action between

the branches and roots so long as no disturbing cause intervenes to disarrange it. The increase of size in a plant, the amount of its secretions, and the extension of its roots, are all dependent upon the amount of healthy foliage it contains, and the more extensive the spread of its leaves the greater the quantity of wood matured, other things being equal. Diminishing the foliage while it is active tends to retard root formation, and consequently so far weakens the plant. Pruning in winter, after the yearly growth is completed, tends to strengthen the plant, because it throws the proponderance in favor of the roots. With weak plants this principle shows the best mode of encouragement. Allow an unrestricted growth during summer and prune down to a low point in winter, thus throwing additional vigor into subsequent growths.

Another matter of importance refers to the best season for performing winter pruning. It is well known that plants continue to absorb food by their roots during winter, except when the sap is actually frozen; this being equally distributed over the plant, it is evident that where pruning is deferred till February much of this winter accumulated vigor will be cut out and wasted. On the contrary, when pruning is performed in November the extent of branches is lessened, and the sap collected by the roots during winter affords an additional stimulus to the buds that are retained, which will cause them to push earlier and grow with increased vigor and rapidity; a matter of great importance where the summers are short.

SPECIES OF GRAPES MOST LIABLE TO MILDEW.

There are several species of the grape indigenous to America. Hitherto our most valuable cultivated varieties have originated from the *Vitis labrusca*, or Fox grape. Of these varieties the most familiar are the Catawba, Isabella, Diana, Concord, Hartford Prolific, &c. Another class are evidently descendants of the *Vitis cordifolia;* of these we surmise that the Clinton, Taylor, Alvey, and probably the now-famed Delaware and Cuyahoga may be enumerated. In their wild state the *Vitis labrusca* is much more sensitive to mildew than the *Vitis cordifolia*, and in their respective descendants the same peculiarities exist. This is, therefore, a consideration of immense moment to those who are attempting to improve our native grapes by hybridization, since, by confining their labors to that class most hardy and exempt from injury resulting from atmospheric changes, the probability of securing a valuable hardy grape is greatly enhanced.

In using the term hardy in this connexion it may be mentioned that it does not refer to the ability of the vine in resisting cold during winter. Probably there are few grapes, either native or foreign, that would not resist our most severe winters, provided their growths were thoroughly matured. But when the growth is interrupted during summer by mildew or any other cause the wood fails to mature; it has not been sufficiently hardened to withstand the alternations of heat and cold, freezing and thawing, to which it is subjected. This is the greatest consequent evil of mildew, a gradual weakening of the plant; first, by the destruction of its summer verdure, which prevents maturation of the growth; the immature wood is then destroyed by frosts, and a continuation of such calamities enfeebles the plant until it finally dies, or is cut down as a cumber of the ground.

SHELTER.

We know of no expedient that offers greater prospect of success than an efficient system of sheltering vineyards. Of course the selecting of a site physically sheltered will not be overlooked; a southernly slope protected by adjoining woods would, so far, be favorable; positions contiguous to lakes may, also, be found to be more generally exempt from mildew, the moisture in their vicinity preventing the too great evaporation from the foliage; but where none

of these natural advantages are available I would strongly advise planting irregular belts of evergreen trees and shrubs, so as to completely enclose the vineyard; and if on an extensive scale, hedges of the arborvitæ, hemlock, spruce, and Norway fir should be freely interspersed to break winds and currents. By skilful arrangement in grouping and massing the trees a pleasant landscape effect could be produced; the hardy varieties only should be used, such as the white pine, Austrian, Scotch, and balsam firs, Norway, white, and hemlock spruces, red cedar, and arborvitæs; a few close-growing deciduous trees might, also, be added. Of course they should be planted sufficiently distant not to interfere with the roots of the vines.

THE EXOTIC OR FOREIGN GRAPE.

It is part of the pomological history of the country that all attempts to cultivate the foreign grape in the open air have proved unsuccessful. Many attempts have been made, and much labor and expense have been devoted in the endeavor to render their cultivation profitable. The prevailing cause of these failures is the constant tendency to mildew, and although many expedients have been resorted to with a view to arrest the progress of the malady, none have proved available in extended field culture. It is true that particular cases might be instanced that have been partially successful, and a crop of very well ripened fruit secured; but these cases are merely incidental, depending upon some local circumstances or peculiar favorableness of climate, and are not constant. That they will ripen occasionally in the open air shows very conclusively that the heat and length of our summers are sufficient for their maturity, and that they will also stand the winters when the wood is matured; but the all but a certainty of mildew arresting their summer growth has led to the adoption of protection in glass houses; and graperies have now become as common as well as one of the most useful adjuncts to the country residence.

It is now about ten years since I first published in a horticultural journal the results of my observations and experiments on the origin of the mildew, that proves so destructive to the foreign grape, and since then I have had favorable opportunities for repeated experiments, which have enabled me to simplify and systematize a mode of management that is within the most common capacity in vegetable culture, and which is now very generally recognized by many of the most successful grape culturists in the country.

FOREIGN GRAPE MILDEW.

We have previously stated the opinion generally adopted by naturalists, that mildew is a consequence and not a cause of disease. The erysiphe mildew, that is most prevalent on the foreign grape, originates in the injurious effects of dry air acting upon the surface of tender vegetable tissue; the plants are brought into a diseased condition from excessive evaporation, causing a demand for moisture by the foliage, which the roots are unable to supply. A similar result may be observed on many plants that are natives of comparatively cool and moist climates. The gooseberry attains its greatest perfection where the summers are moist; in America they suffer from a species of fungus closely allied to, if not identical with, that on the grape. The English oak and hawthorn and the Persian lilac are farther examples of plants that become mildewed during our driest summers, and which is arrested and destroyed after rains and dull moist weather.

When plants are cultivated in glass structures they are placed in an atmosphere completely under control. Nevertheless, in the earlier attempts of foreign grape-growing in houses, the tendency to mildew was one of the greatest evils the grower had to contend against, and applications of sulphur were invariably recommended as indispensable to success. In most gardening works of this

century sulphur has been given as an antidote to all kinds of mildew, and various modes of using it have from time to time been suggested. It was evident that, although the culture of grapes in houses facilitated the efficacy of remedial applications, so that with care the mildew could be prevented or arrested. its origin was not fully understood, and even in some of the most recent works on the grape we find these old rules repeated, instead of adopting a course of culture that would prevent its appearance.

ARRANGEMENT OF A GRAPE HOUSE.

Having become convinced that the main secret in the culture of the foreign grape consisted in keeping a certain supply of moisture in the atmosphere, and that in this climate the strict gardening rules with regard to the management of glass structures, which comes to us from European sources, were not only unnecessary but founded on erroneous notions, altogether inconsistent with the discoveries that have been submitted to us as the result of scientific investigations, a course of practice had to be inaugurated in accordance with theory that my observations had led me to adopt. The most important requirement seemed to be that of providing for a gradual conversion of water into vapor, as the temperature of the house increased, so as to prevent excessive mechanical evaporation from the surfaces of the vines. As a means of supplying this moisture, I provided a quantity of shallow tin pans, holding about one inch of water. These were distributed freely over the floor of the house, covering at least one-fourth of its entire surface. It soon became evident that these evaporators were not sufficiently sensitive for the purpose required, such a body of water requiring to absorb a considerable degree of heat to cause sensible evaporation, and that the most effective mode was simply in keeping the surface of the soil always damp; the water, being lightly distributed in this manner, was readily converted into moisture when the rays of the sun were permitted to reach the surface of the soil. But here again a difficulty was met: the ordinary method of training the vines close to and under the entire surface of the glass presented an impenetrable barrier against the rays of the sun striking the ground. I had for some time been under the impression that much valuable training surface was lost in this mode of training, and believed that if the glass was kept clear of foliage, and a system of perpendicular trellising adopted, a more extensive training surface would be secured, and, as a consequence, a heavier crop of fruit procured from a given surface of glass. In addition to these advantages, I had observed that grapes produced on perpendicular trellises were more exempt from mildew than were those bunches that hung down clear of the foliage, as in vines trained close to the glass; when the leaves incline upwards to the light the fruit is thus entirely exposed to all casualties that may occur from injurious atmospheric currents; on perpendicular trellises the foliage covers and protects the fruit, at least to a certain extent, and liability to mildew is so far abridged.

Another point presented itself as worthy of consideration: where the roots are allowed to extend in outside borders, and in the event of heavy rains in August, more especially if succeeding a period of continued drought, the sudden saturation of the soil tends to produce oïdium, and injures the flavor as well as the keeping qualities of the fruit; these results seemed inevitable so long as the roots were roaming unrestricted outside the house, for although coverings might be applied to the soil over the roots, yet they could only be partially effective. With a view, therefore, to combine as far as practicable the various advantages just enumerated, I commenced in 1857 the erection of a house, a section of which is here shown, and which has fully answered all my expectations.

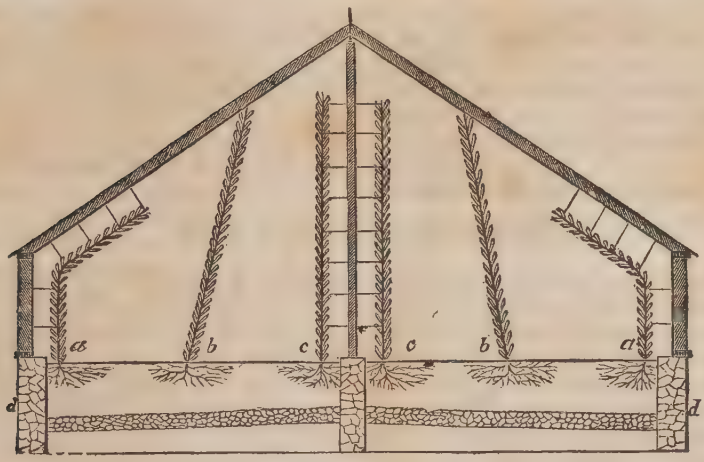


Figure 2.

Here the rows marked *a* are confined to about one-third of the roof surface; the glass above that point being kept clear allows the admission of sufficient light to rows *b* and *c*. The rays of the sun have also free access to the soil, which produces evaporation. The border is enclosed within the foundation walls, so that the roots are wholly confined within the glass roof. Thorough drainage is secured by the stratum of loose stones at *d*, above which is the prepared border. In this arrangement it will be perceived that there is a gain of training surface, and the perpendicular trellises are favorably placed for ripening a fine crop of fruit, which colors to perfection even at the lowest point of the centre, at *c*.

It is well known that high-peaked roofs are objectionable as plant habitations; the heat increases with the elevation, and the same plant will thus have its several portions in various temperatures. This is particularly the case with many curvilinear roofs; being narrow and high they are very difficult to manage with regard to ventilation. I conceive that no better construction could be adopted for graperies than that of projecting a series of small, low span roofs, the highest portion not exceeding ten feet; the interior arrangement being similar to an outdoor vineyard, the plants trained on upright parallel trellises. The following sketch (figure 3) shows the appearance presented by this style of building.

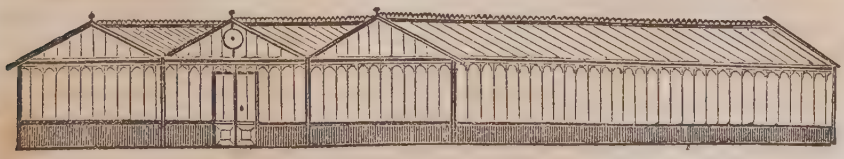


Figure 3.

VENTILATION AND TEMPERATURE.

Another peculiarity which has not yet been mentioned in the construction of the house (Fig. 2) is the absence of all bottom ventilators. When the idea was first advanced that currents of air from low ventilation were a source of mildew, and that grape houses should be built quite close at bottom, it met with

considerable opposition. Before advancing the idea, however, I had become convinced of its truth, and at the present time no good grape-grower ever thinks of giving air at the lower portion of the house, at least early in the summer. When under intelligent management, bottom ventilators may, at certain seasons, be used with advantage, but in many instances I have deemed it expedient to guard against casualties that might occur from careless management, by having the fronts fixed so that no ventilation could be given. Where grapes are kept hanging on the vines for several weeks after ripening, ventilation will be required to dispel damp, but when fruit is to be kept till December a heating apparatus should be provided; indeed, no grapery can be complete without some means of imparting warmth, as it simplifies care in spring when the plants are budding; again, in the event of early frosts during the autumn, a slight fire will often be found of the greatest utility in ripening the wood.

Although the hygrometrical condition of the atmosphere is of great influence, yet the temperature is of equal importance, and the amount of success will depend largely upon the manner in which ventilating is conducted. The prevailing mode of treatment of glass structures is that followed in Europe, and recommended in most horticultural books in America, and which may be stated in general terms as follows: "Air regularly every day liberally when the temperature rises in the house, beginning by opening the top ventilators a little in the morning, more at midday, and then gradually closing them in the same manner." Many persons are deterred from indulging in horticultural pursuits from the supposed amount of labored details that are laid down as being necessary to success. That very much of the details given for the management of graperies is not altogether indispensable I am well convinced, and for my own part I have had the greatest success when the ventilators were left open day and night, and no alteration made for many months in summer. To those unacquainted with vegetable physiology, but well versed in the common routine rules of grapery management, such an assertion may seem simply absurd; but in cultivating plants under glass we must first thoroughly understand the reasons that render such a course of treatment necessary. We should also avoid, as far as possible, a mistaken desire to keep plants in an artificial rather than in a natural condition. In no point is this more likely to occur than in that of ventilation. One of the most injurious and prevailing errors in the management of all kinds of plant houses is that of keeping the night temperature too high. It is true that plants will continue to grow in the absence of light, in a high temperature, and this circumstance has been advanced as a reason for the practice. But it is well to bear in mind that all growth made during darkness is at the expense of the growth made during the day, for it is only in the presence of light that those chemical changes are vigorous which transform the crude matters absorbed by the roots into the vegetable product, so that nothing useful is gained by the mere elongation of growth during darkness.

In some experiments which I directed several years ago, in order to test this subject, it was found that the growth and ripening of fruit were accelerated very considerably when the night temperature was lowered from 25° to 30° below that of the day, and the grape is no exception to these rules.

I will now describe very briefly my mode of managing the temperature of a grapery. It will be understood that my remarks are chiefly applied to what is termed a cold grapery. In houses where forcing is conducted, although the principles of action are the same, yet the details are somewhat varied.

It has already been remarked that all graperies, to be perfect, should be provided with means of creating artificial heat, if required. Where no such convenience exists the grapery should be well ventilated during early spring, so as to retard growth as long as possible; indeed, it ought never to be entirely closed so long as there is no frost. This care is absolutely necessary, not only on account of the liability of injury from late frosts, but it inures the young

growths, so that they are enabled to withstand sudden or extreme changes. I have frequently seen the thermometer indicating 32°, when vines were in flower, without doing them any injury; and 40° at night is quite high enough until the weather becomes settled and warm. Of course we are referring to vines habituated to this treatment. Plants that have been kept close and warm, and in a night temperature not lower than 55°, would be injured by suddenly lowering to the extent here mentioned.

After all likelihood of external frosts is passed, which is about the middle of May in this locality, the ventilators are left open to the same extent day and night. The whole ventilating capacity of the structure is not thus early employed, but as the season advances they will gradually be opened to the whole necessary extent; but the rule is strictly enforced that when once opened they remain so. It need not be supposed that they are not to be closed in emergencies. During high storms of wind or rain blowing into the house, a temporary closing, at least on the exposed side, will not interfere with the general treatment here recommended.

As the season advances a day temperature of from 90° to 100° will not be excessive; and if the thermometer falls down to 60° it will proximate to what I have found to be most suitable, always supposing that during the whole season from the time that the bunches make their appearance until the fruit changes color the surface of the soil is never allowed to become dry. The necessity for this practice has already been demonstrated, but it will bear repetition, as it is the main point in grape culture.

BORDERS AND THEIR MANAGEMENT.

The soil in which the roots are disposed should be as much under cover, and thereby as much under control, as the branches. The borders of graperies are usually made too rich. Any common soil that will grow a good crop of corn will grow grapes. It is not the design of this paper to enter minutely into *all* the details of grape-growing; therefore we will only briefly refer to the preparation of the soil and planting. The bed on which the soil is placed should be rendered proof against holding stagnated water; eighteen inches, or, at most, two feet of soil will be amply sufficient. Soil of a tenacious character should be avoided; a sandy loam is best; and when we add that an annual application, three inches thick, of well-rotted stable manure should be laid over the border in the fall, we have said all that is necessary. Highly enriched borders produce large bunches of flavorless fruit, badly colored, and watery, encourage succulent growths which do not ripen, and pave the way to all the diseases the grape-vine is heir to.

Another erroneous idea has been fostered with regard to inside borders, such as are here described; that is, the presumed difficulty in keeping them supplied with water. The grape is not an aquatic plant, although the recommendation of some writers would almost lead us to believe that it was. "Water well every day" is a dogma of some of the powers that be in *grapeology*. Advice so indefinite, we may be assured, never emanates from practical culturists. In all that relates to plant culture under glass, no operation requires so strict attention as that of watering. In the management of green-house plants the "water well every day" system has killed more than all other causes combined. In our borders, as shown in Fig. 2, we find a good watering once in a month or six weeks to be amply sufficient. This presumes an application where each square foot of surface receives about one gallon. This, it will be understood, is quite independent of the daily sprinklings, which are necessary whether the borders are inside or outside the house. These sprinklings, however, prevent any waste by surface evaporation of the water in the border, and the plants have the full benefit of the application.

As everything connected with the health of the plant will influence its immunity from diseases, we may remark that none but young healthy plants should be set out. It is a great error to suppose that large, high-priced plants are preferable to young plants with healthy, uncramped roots, Even two-year plants in twelve-inch pots will have their roots cramped and twisted so as to require more than a season's growth to remedy. Healthy one-year old plants in eight-inch pots are to be preferred. Indeed, the finest growths we have seen were from plants raised from cuttings of a single eye the same season that they were planted out in the grapery.

GRAPE-VINE CULTURE AND WINE-MAKING.

BY JOHN F. WEBER, OF HAMMONDSPORT, STEUBEN COUNTY, NEW YORK.

PROPAGATION OF THE GRAPE.

THERE are different modes of propagation, of which many of the slow and old-fashioned have, of late, been dispensed with. The natural method of pro pagating the grape-vine, as well as plants in general, is by its own seed. But, as is true in most cases, and especially with the grape, plants have been subjected to different climates, from hot to cold, different soils and treatments, they lose more or less of their original character; and, as they are planted near and become mixed with plants of their own species, they will be impregnated from them, and, therefore, become unreliable to reproduce plants of the former good qualities. Indeed, no other plant inclines so much to degeneracy as the grape-vine. In some exceptional cases good results have been obtained by propagating from the seed. For instance, the Concord, Hartford Prolific, Diana, and many other varieties, are offsprings from plants possessing little or no superiority to *them*. This, however, does not prove the capacity of the grape seed to reproduce plants of the same character and merit as its parent. It is, nevertheless, a matter of great importance to continue experiments in growing from seeds. By good judgment in the selection of varieties new kinds may be obtained which are hardier and better adapted to certain localities where the original vine would not thrive. If it is decided to raise grape-vines from the seed, plants of strong, healthy habits should be chosen, and, from these, clusters perfectly ripe should be selected and hung in a cool room till spring. The seed, being then perfectly ripe, will be sure to germinate. The seed may be sown in shallow seed-pots, and started in a hotbed, or without pots in the same. In either way the seeds will germinate and thrive best in a compost made of turf, rotten manure, and sand, also by maintaining an even, genial temperature of 60 to 65 degrees. With good care they will grow strong enough the first year to endure transplantation in the open ground the next spring. A warm exposure, well sheltered, should be chosen, the ground well prepared, and the weeds kept down during the season. When the winter approaches they should be covered with straw, or anything that will keep off the frost and ice. The second year they may remain in the same position, but the third year pruning should be commenced by cutting the canes back to two eyes, from which the young wood, the following spring, is pruned off to six eyes, four of which are to be laid in the ground to make new roots, and the other two left out to form bearing wood. The culture then is the same as with other old established plants.

The first fruits will indicate the quality, even if they show, by a small amount of saccharine contents, much acidity and tardiness. They may improve by good culture and age, to considerably good, and perhaps first-class wine grapes. But should the first fruit be watery and flat no good result can be expected, and such plants may be cast off at once. The other mode of propagating the grape-vine is by cuttings. Since young grape plants have been in so great demand, not much trouble has been taken to select the proper material from which to propagate them. Anything in the shape of the species *Vitis* would do to supply the wants, and of course was easily converted into a young grape-vine, fetching from so many cents to so many dollars. Many vineyards, otherwise well adapted to reward the outlay a hundred fold, have thus been filled with bastard and worthless plants, much to the mortification of their owner. But as long as rooted cuttings are offered at a few cents per hundred, purchasers may depend that two-thirds of them are worthless trash, not worth the cartage. It is so easy to root cuttings, (and the enterprising spirit of a majority of the tillers of the soil being animated by the extra high prices given for grape roots,) that gardeners, nurserymen, and farmers went in with a rush to propagate from anything they could obtain to supply the market and fill their purses. The consequence is that owners of vineyards, which are in bearing order, now look with surprise at the great variance in their Catawbas, Isabellas, Delawares, &c., &c. Hardly two look alike. On one hill the fruit and everything looks right, the vine healthy and free from diseases, the clusters plump, coloring slowly but steadily, and finally attaining a perfect state of maturity, just what is required of a good table or wine grape, while on the next hill the reverse is found. The bearing shoots are thin, the foliage of a yellow, sickly color, the clusters loose, the berries covered with brown specks, and every indication of dry rot, bitterness, and decomposition. The fruit will seem to ripen earlier, but will soon fall off or rot. And yet, no discrimination is made between those two hills. The cuttings from both are saved, rooted, and sold. This accounts for the disappointment of the owners of many newly set vineyards. It is with grape-vines very much as with cereals—any seed, however poor, will germinate and grow; and so grape-cuttings will strike roots if brought into contact with good old mother earth; in other words, if they are stuck in the ground they will grow. In order to obtain plants which can be relied upon, the very best judgment is necessary in selecting the vines from which the wood is to be taken. A good time (and probably the best time) to select the vines is when the fruit is full-grown, and nearly ripe. The propagator has then the best chance to examine his grape-vines, and to mark those which appear in every respect healthy and thrifty, their clusters properly shaped, plump and perfect. A straw band, or, what is better, a willow twig, may be tied around a shank to mark such vines, which will then, in pruning time, be easily found. To "select from the best the very best" should be the rule strictly followed by every propagator, no matter whether he raises plants for his own use or for sale. After the collection of good materials has been properly attended to, the canes are cut into pieces from four to five eyes long; these, tied in bundles of from one hundred to two hundred and fifty, and buried in the ground, there to remain during the winter, providing that the pruning of the vineyard has been performed at the proper time; that is, in the fall. The next spring a dry, partially shaded spot should be selected, trenched at least two feet deep, and made rich by working in old rotten cow-dung, or scrapings of the yard. Then, when the ground becomes warm and fit, perhaps some time in April, the land is laid off into beds and squares, and rows marked out and shallow trenches, from four to six inches deep, dug, in which the cuttings are placed. In my experience, I have found that the shallower the cuttings are put in, the surer and better they will root. The cuttings are placed in a standing position, so that even by trenches only 4 inches deep all will be covered with earth except one eye. In the row they

may be placed from three to four inches apart, and the distance of the rows should be from one foot to eighteen inches. When thus planted a slight mulching, at once applied, will retain the moisture through the hot summer and keep down the weeds. Should the summer be very hot and dry, they may require watering occasionally, which should always be done in the evening. Weeds must never be permitted to grow among them. In the fall they are taken up carefully with the grape-hoe or garden fork, and placed in the ground again during winter. The next spring they are fit to set out in the vineyard or to be sold. Any that are left of the last year's growth have to be cut back to two eyes, and either planted back again in the former bed, or taken to some convenient spot and allowed, at least, one square foot of distance.

The next mode of propagating the grape-vine is by layers. Shoots are allowed to grow as near to the ground as possible the preceding year. The next spring trenches six inches deep are dug along the side of the rows, into which these canes are placed; that is, one into each trench. They are fastened to the bottom of the trench by little wooden pegs three or four inches long, and left uncovered until the eyes have made four inches growth, when about one inch of ground, well pulverized by hand, is put in for a cover, which has to be continued through the forepart of the summer until the trench is filled up. In the fall the cane is cut off from the vine and taken up carefully with a grape-hoe or garden fork. Each eye will have made a strong shoot and roots. It is then cut off from the cane and becomes a plant of itself. They are keeled in and taken care of the same as other young plants during the winter. These are to be preferred to others, as they are stronger and will bear sooner.

Still another mode of propagating is from single eyes. This is the method practiced most with new and rare kinds. The wood is obtained in the fall and put in a cool, dry place in the earth during the winter, so that it may be handy when wanted. It requires glass to root them—either a propagating house or hotbed. About the middle of January is the time to begin. The first requirement is the facilities and maintenance of a steady, warm temperature, obtained either by apparatus, stove, flue, tank, &c., &c. The hot-water apparatus with a tank, above which the bed is placed, is now most in use. The tank is supplied with water, which is heated by boiling water driven from the boiler, through iron pipes, through the tank and around the house. Such a tank furnishes the best bottom heat and moisture at the same time. The rest of the tank or box is filled with well washed sand, into which the eyes are put. If the wood were ripe and a proper temperature maintained, every bud will grow and make a plant. If the conveniences for such propagation are not at hand, and a hotbed is resorted to, the operation has to be delayed until February or March, when the most severe winter weather is past. The hotbed requires the same fixture and preparation as for other purposes, except that here sand is used where otherwise compact. It has been found advantageous for hard wood to graft the eyes on roots to secure both a sure growth and a strong plant. Roots of the size of the cane are generally procured from any variety of grape-vine, cut up to the length of two or three inches, the fibres cut short, to one-fourth of an inch, on which the eye is then tongue-grafted, and tied on with bass; it is then plunged in the propagating bed to grow callous and strike roots. The high prices which new and rare varieties have commanded have brought this mode into general practice, but it has yet to be proved whether such grafted vines will keep their original character. It seems rather doubtful. Some varieties may be greatly improved by cross-grafting if the nature, both of the graft and root, is well considered. But as long as grape roots of approved standard vines are scarce there will be few found to spare for such purposes, and hence little or no attention paid to that all-important point. From the middle of May to the first of June these plants will be fit to set out in the vineyard, the remainder being kept in the nursery or plant bed. There are still other modes of propagating,

but as they belong either to the improving part or are applicable only in old, established vineyards, they need not be mentioned in this place.

Having given an abstract of the different modes of propagating the grape-vine, it will be proper now to pay attention to the preparation of the soil and the planting of the grape. In regard to the best soil for a vineyard, position, climate, and other things being favorable, Celsus says, "The best soil is that which is neither too bound nor too loose, but more bound than loose—neither too poor nor too rich, but more rich than poor—neither on a dead level nor on a steep hill or mountain, but on a gentle slope with a good aspect to the sun—neither dry, springy, nor damp, but moist enough to support the root of the vine;" but this moisture must not be charged with salts, either bitter or sour, as the flavor of the wine will thus be destroyed. Virgil warns us that "Soil containing too great proportions of salts is injurious to vegetation. Ever so much ploughing will not improve it; the fruit tree and the grape-vine will degenerate." There is scarcely a word more to add. These rules, found practicable centuries ago, will hold true until the culture of the grape-vine ceases altogether. In locating a vineyard a southeastern declination of from twenty to thirty-five degrees is preferred, but many modifications have to be made, according to the latitude and climate prevailing. In northern climates the vineyards require all protection from high, piercing winds and the full exposure to the rays of the sun during the whole day, while in hotter climates further south the more they will want protection from the intense heat and from exposure to cooling breezes; therefore, high northern or northeast aspects will be best adapted in such latitudes.

The success of a new vineyard depends most upon the proper selection of its plants. It is all important to use none but well acclimated plants, and only such varieties as have proved themselves of undoubted good quality. As long as new kinds have not been thoroughly tested they should not be chosen for extensive planting, even if they can be procured as cheap as old standard varieties in which the country abounds. The next thing to be considered is the spot on which certain varieties will thrive best. Their time of ripening and maturity must be brought into conformity with the locality. For instance, an early ripening grape-vine should be set on the coldest and shadiest place; while a late grape should have the best chance in the vineyard, so as to ripen at the same time with the rest of the crop. Then, again, if the object is to raise grapes for making wine, none but the very best varieties should be selected, and those always with due consideration to the climate and soil of the locality where the vineyard is to be established. It is a well-known fact that grapes, removed from warm climates to cold regions, will degenerate and produce inferior fruit, while, on the other hand, vines and fruit trees, in general, will greatly improve by translocation if it has not been too abrupt and sudden. A plant intended to be transferred from a warm country to a less genial climate should have a relay station where it may be exposed to a colder temperature, and thus hardened. Then, perhaps, it would be more prudent not to take that same plant, but to get young specimens of it by propagation to be taken to its final destination, and, even then, better to continue until the third or fourth generation is shown to be hardy and acclimatized.

The history of the grape-vine shows that it is a plant of a hot zone. It was first found and noticed in Persia and Palestine, whence it was brought to the southeastern countries of Europe, thence gradually spreading all over that continent. Centuries have passed since then, but the grape-vine has not ceased to reward intelligent and industrious men who have engaged in its planting. In consideration of these cardinal points, the planter of a new vineyard will procure a good and suitable stock. For northern climates the selection of varieties is rather limited. In a nearly endless list only a few have proved themselves suited to an extensive culture. The Isabella, Catawba, Concord, Delaware, Diana,

and a few other kinds are, at present, the only varieties which repay the expenses of setting out in a vineyard. Many foreign varieties have, thus far, been cultivated with success, but still on a small scale. Here, in our valley, they seem to thrive remarkably well, and both wood and fruit mature perfectly. But they are generally under the care of skilful German vine-dressers, who take care of them as they have been accustomed to do in Germany. All of the first-class German grapes, such as the Gutedal, Priesling, Traminer, Early Black Hamburg, Tokai, Bulander, Trollinger, &c., have fruited here, and their varieties increase in number every year. In more genial southern climates the selection of a stock is far easier, because they will do well there, and, therefore, it is only necessary to choose such kinds as combine quality with quantity. The most improved varieties, however, should be cultivated only in those favored regions where a full return can be obtained. In regard to the proper selection of varieties for a vineyard, Columella quotes—that, if the object is to make wine from grapes, such kinds should be selected as bear abundantly and grow strong. This will not only increase the reward of the owner, but will also secure the duration of the productiveness of the vine. The best varieties are such as thrive and bloom gradually in the spring; which will not ripen too late, nor suffer from frost, heat, or blight, from excess of rain, dry weather, or rot. Grape-vines of such qualities, even though they should bear but moderately, should be our choice, if only their wine is of first quality. Almost everywhere the valleys and level land will produce larger crops, but the hills those of a more superior quality. On hills with a northern declination the vine will bear more, but with a southern aspect the wine is best. These general rules, laid down centuries ago, may be applied now and always with the same good results.

Next comes the preparation of the soil. Soils naturally good require but little labor to make them fit for the vine. The land must be cleared of stumps and of everything which may obstruct the development of the plant or hinder the easy tillage. On steep hills, where horses and a plough cannot be used, the land has to be trenched by hand. If the ground is loose and porous two feet deep is sufficient. It has then to be guarded from heavy rains and floods by terracing. The topography of the land will indicate how near, how high, and how far apart such embankments should be. The best supporter, next to a terrace, is a stone wall, which is both beneficial and durable. The stones retain the heat and moisture as they absorb the intense rays of the sun during the day, and by their heat temperate the cold, chilly air. Vineyards with many stone walls will always ripen their fruit earlier and better, and are, consequently, more valuable than those without. Another great advantage to be derived from stone walls is, that it is best to obtain the warmest and most sheltered spot for rare and valuable vines; these, trained on trellises, on the wall, may be safely cultivated in a much rougher climate than they are brought from, and will surely mature their fruit. I have seen, in one of my relative's vineyards, a grape-vine brought from the most southern part of Hungary, trained on a stone wall facing the south, which would every year produce the same superior fruit as in its native country, although the temperature is much higher there than in Saxony, where I saw it. Still another advantage of stone walls is that of saving land, which is otherwise much taken up by the deep declination and grades of the banks. If, however, stone walls cannot be afforded, the grades of terraces should be turfed, or, at least, sown with grass-seed or white clover at the outset, to protect them from destruction by heavy rains and to keep down weeds which would otherwise hedge there and make it difficult to keep a vineyard clean, not to mention its shabby appearance. On less steep hills, the work of trenching may be done by horses, ploughing (with a side-hill plough) two feet deep or more, according to the texture of the soil. But bound, tenacious soils require deeper trenching, which has to be done by hand,

When the ground is thus prepared to receive the grape-vine, there is still

another very important point to be considered, which is the control of the water. If there should be springs they must, of course, be drained off; but the most trouble and damage is generally caused by heavy thunder showers, or by lasting rains, when the water, beginning with little, scarcely perceptible grooves, in the upper end, leaves deep ravines and gutters before it reaches the brook or any other natural passage, and carries down with it soil, manure, and plants. Thus all the hard labor and expense are often lost in a few hours, and the land often ruined forever. To guard against such damages a spacious, open ditch, well stoned, should be opened in the upper part of the vineyard, following the declination of the land, receiving and carrying off all the water from the land above; then alternate ditches should be dug through the whole vineyard to carry off the water. These ditches will be durable, if they are well stoned, or at least turfed or sodded. Otherwise they will be useless, or worse than none at all. It should be mentioned that the course of such open drains must correspond with the grade, and not necessarily be made straight, if there should be a rise in such a line. The distance from one to another may be from seventy-five to one hundred and fifty feet, according to the steepness of the hill and the velocity with which the water passes down. On our hills they serve admirably, and it has been ascertained that they are the only means of preventing a vineyard from being spoiled by heavy floods. These drains or ditches are made now in all vineyards throughout the whole valley.

Being ready now to set the vines, the land is laid out into squares, containing one, two, or more acres, leaving roads, cross-paths between, which will accommodate the hauling of manure on the vineyard, the carting of stones and rubbish from the same, and likewise the gathering of grapes and their transportation to the wine-press. The rows are then marked out by a line, the distance measured, and the place marked by a stick where each vine is to be set. It is important not to set them too close, as such crowded vineyards never have, nor ever will, do well. Strong varieties, growing much wood, require still more space. Isabella, Catawba, and, in fact, all the present known varieties, should be allowed, at least, six feet between the rows, and even ten feet, if they are intended to be trained on trellises; while, on stakes, six feet square may be sufficient. To facilitate, then, the management of the vines, each variety should be planted by itself. A rule is to plant young and tender vines shallower than older and stronger ones; but both will be greatly benefited by mixing in a shovelfull of good, old, compact manure around their roots. Strong, leading roots, and even fibres, have to be cut back to four or six inches before setting. Young vines, with small roots, should have left three or four eyes from their wood, to be buried, to make roots, while strong plants may be pruned back to one eye at once, and that, as well as weak plants, left above ground to make shoots. When vines are taken up to be planted they should never be exposed to the sun or the dry air, but wrapped in some cloth matting, or anything handy, to keep them moist, and then taken out one by one. Our German vine-dressers use the grape-hoe—which instrument has now come into general use here—for digging the little trench and covering it again. With it they will plant from five hundred to eight hundred vines in a day. This simple, but very practicable instrument serves for every purpose through the whole season, and, except where the plough can be used, allows all other tools to be dispensed with.

If cuttings are to be planted, the grape-hoe, or, on land free from stones, the iron plant stick are the most servicable instruments with which to perform the work. When the root or cutting has been covered up to one eye a handful of fine earth is put over this, too, to prevent its bursting out too quick before the roots begin also to grow. A little straw or coarse manure put over the whole will insure its growth and pay well. Having strictly adhered to these principles and rules, there will be no occasion to complain of failure in such an enterprise: on the contrary, the young vineyard will be a favorite source of interest and of

capital and labor well invested. It is scarcely necessary to add that such a young plantation requires great protection from all depredations of animals running loose about the roads, and that no weeds must be allowed to grow. Nothing looks more sad and dreary than to see the young, noble grape-vine choked by weeds, betokening certainly the carelessness or ignorance of its owner. To pay close attention to these two points is all that is necessary for the first season. Before winter the single shoot which the vine was permitted to grow is pruned back to two eyes, and these covered with earth as a protection from frost and ice, and also to keep them under control, so that they will not commence to grow before the weather becomes settled in the spring. If the proprietor of such a young vineyard thinks that he could not well afford to spare the land three or four years before getting a crop, and the soil is otherwise productive, it will not materially interfere with the young vines to plant thinly among them cabbage, potatoes, beans, or any kind of root crops, allowing the grape-vines liberal space, and always keeping in mind that they are the objects first to be cared for. Perhaps it will in many instances be more beneficial for them, as their master or protector will thus be called oftener among them when he cannot fail to see whether they suffer.

The next—that is, the second year—the first work to be done is to remove the ground or cover from the two eyes as soon in the spring as the weather appears settled, and to procure stakes to tie the growing shoots to during the season if it is preferred to build trellises at once. The ground has to be stirred often, and the weeds kept out. In the fall, as soon as the plants become dormant, they are pruned. Now begins the training of the vine. As there are so very many different modes, we need only to treat of those most practiced. The object of pruning is to regulate the growth and bearing of the grape-vine by removing all such shoots and branches as obstruct the development of the vine, inasmuch as it is necessary to concentrate the strength of the plant in order to perfect its fruit. It requires sound and well-matured wood to bear fruit, and the fruit will never come to perfection when light, sun, and air are wholly or partly excluded. The next object of pruning is to keep the vine in a permanent state of productiveness; always improving instead of degenerating. This is the cardinal point which every vine-dresser should look to and never deviate from. The grape-vine may be divided into the following parts: 1st, the stem or trunk, which is the part from which roots and branches start; 2d, the branches, or, as they are technically called, "shanks." These proceed from the stem, and are the parts from which (3d) the bearing branches or canes are emitted, and (4th) the young, growing shoots starting from the canes. The wood and bark of the vine harden so quick that they become unfit to produce bearing shoots when only two years old. The bearing wood, therefore, has always to be obtained from the last year's growth. It is necessary to provide for a surplus of wood, so as to enable the vine to produce full crops according to its age and vigor. There must always be a double set of shoots to bear the present year, and to make bearing wood for the next. The first are pruned off when they have fruited; the second, shortened either to spurs or bow according to the training system, age of the vine, and other circumstances.

After having decided upon a system, the next attention should be paid to the training of the vine according to that system. It is best to begin with the first pruning to obtain gradually the desired frame and shape. There is, 1st, the concentrating system, which is much practiced in Hungary, some parts of France, and Germany. Beginning with plants two years of age, they are pruned back again to one eye, and from that the cane also the third year. This will finally form a knob, or, as it is properly called, a head, from which will emanate more or less sprouts every year. These are allowed to grow through the season. When the vine becomes old and strong enough to bear, two or three of these sprouts are pruned to spurs of two or three eyes, and the rest removed. This

is continued (the spurs increasing in numbers) according to the strength of the vine; those which have fruited the preceding year are pruned off the same fall or the next spring. These vines support themselves, and neither trellises nor stakes are required. This mode may be practicable for very dry, poor soils and hot climates, but it would be vain to attempt to train Isabellas and other rank-growing varieties according to such a system, unless their shoots were supported by stakes.

The next is, 2d, the dwarf system, known also in ancient times, and practiced more or less till now. There are many variations of this mode, but the most common is as follows: The stem of the vine is allowed the size of from six to twelve inches, with three or four shanks of the same length, branching out all around, on which spurs of from two to five eyes are pruned for bearing, and afterwards removed, while young shoots are raised at the same time to take their places. This training gives the vines the appearance of dwarf trees, and the more skill there is exercised the better they will look.

Another mode is, 3d, the shank and spur system. This has been practiced since Noah's time in all parts of the world. When the vine is two years old the shoot that grew the preceding year is pruned back to two eyes, from which two shoots are obtained. The next year one of them is pruned back to two eyes; the other is left with from six to eight, to form the stem or trunk. One of the shoots from the spur is removed, the other pruned back to two or three eyes, while on the shank one spur and a bow is left. The bearing wood may be increased, by-and-by, to two long bows of from twelve to thirteen eyes and from four to six spurs. This mode requires stakes to support the vines, otherwise it is carried on on the same principle as the preceding. Almost all sections of country vary from one another in the manner of training and pruning; old habits or certain localities, soils, and varieties of grapes, are the occasions of these variations.

There is, 4th, the trellis system. Different modes are practiced here, too, among which we will treat only of the "high" and the "low" system. For high trellises the shoot, or, better called, the "cane," of the one-year old vine is pruned back to two eyes, from which two shoots are obtained the following summer. These are again pruned to such a length that one or two eyes shall reach above the first wire or lath on the trellis the next fall or spring. The eyes on these canes (except the two on the top) should be rubbed off, or, as it is technically called, "blinded," so as to concentrate the strength into the two. By the next pruning the upper cane is lengthened to meet, by being brought into a horizontal position, the like one on the other vine, while the other is to form the frame for the second tier of the trellis; and, if strong enough, it may be cut of such a length as to go up vertically to reach that, and then run horizontally to meet the other. Both canes are treated alike. Alternate eyes of these canes (where there is no room for spurs) being rubbed off or blinded, the remaining eyes will, during the summer, form bearing wood. For the third tier two other shoots, emanating from these two shanks, are raised, and by the next pruning fitted for the same process, which is continued every year until the last and uppermost tier is framed. At the same time that this framing is going on the vine will be strong enough to bear some fruit. The shoots growing out of the eyes of these horizontal branches are the carriers of it. By pruning they are shortened to one or two eyes; and when the young shoot has made sufficient growth to reach two leaves above the last cluster, they are nibbed in and not allowed to grow any more. It requires considerable practical knowledge to train the vine on a trellis and have the bearing wood equally distributed all over the trellis; but nothing looks richer than a well-shaped trellis covered with fine clusters. With the summer pruning all water-shoots and unnecessary growth is removed, and only those shoots allowed to grow which will make bearing

wood for the next year. In the fall these are cut back to one or two eyes, and those shoots which have borne the fruit are pruned off altogether.

The "low" trellis system differs not very much from the foregoing. The young vine is pruned in the same way, that is, cut back to two eyes at the second pruning; from the shoots obtained from them the frame is made. There are only two shanks trained on one tie, which is from about two and a half to three feet from the ground. These shanks are generally made from eight to ten feet long each. The management is then the same as with the preceding system.

The most important point in grape culture is the management of the roots, the keeping of them in conformity with the branches. As a grape-vine whose roots go deep into the ground is not affected by drought, but rather benefited by dry, hot weather, the planter should always endeavor to prepare the ground so that it may be easily penetrated by the roots. In naturally loose soils they will find little or no difficulty, but bound soils have to be well trenched. Young and otherwise thrifty vineyards having the roots obstructed by a hard, tenacious subsoil, may do well and have the appearance of health and vigor for a number of years, but soon they will show signs of sickness, their top roots becoming soured and finally rotting. The vine then is supported by its top roots only, which, being near to the surface of the ground, soon consume all of the nourishment in this shallow layer, and have either to be manured often or one after another they die. The bearing and influence of such a root-system and the quality of the wine itself require still further investigation. It seems as different varieties of grapes do best in certain soils, their main and top roots are likewise benefited by certain stratas of the subsoil and will have much influence on the development and the quality of the fruit. While the bearing of the surface or dew-roots depends mostly upon the quality of the top soil, limited as these roots are to that soil for nourishment, the food taken up by them has the greatest influence upon the quality of the fruit also. It has been ascertained that a vine with too many top roots will produce watery and sometimes strong-smelling fruit, with a taste like that of decaying vegetable matter. This happens especially on humid soils, injuring the wine and makes it inferior or wholly unfit for market. The chief aim of the vine-dresser must be to obtain a good root-system. In attending to that he must be guided by prevailing circumstances relating to the soil, climate, and locality, condition and age of the vineyard. It must be his aim to encourage the growth of the foot or top roots to penetrate deep into the soil. This is accomplished best by removing more or less of the fibres and top roots. In the spring before the eyes burst out, the ground around the vine is dug up with the grape-hoe from four to six inches deep and all the fibres and roots pruned off close to the stem, according to the texture of the soil. These little trenches may be left open through the summer or the ground put back at once. By leaving them open the lower roots will grow more vigorous and more inclined to reach for moisture and food in the lower strata, but in dry, loose soils it will be advisable to move the earth back as soon as the object is attained. Root-pruning has been practiced with success ever since the commencement of the history of the grape culture. It is as important to the development and long life of the grape-vine as the pruning of its top, and has a similar effect on the quality of its fruit.

A different mode has to be adopted with wet and tenacious subsoils. Although less suited to the grape, such soils may be planted, if the climate is genial, or a market near at hand, where the fruit can be sold for good prices, and good crops obtained. If such land cannot be improved by draining, that is, if from some cause this operation cannot be carried out satisfactorily, there remains nothing more to be done, except to control the growth and formation of the roots, so that they will not be driven into the cold wet subsoil; hence the pruning off of the dew-roots has to be omitted, likewise, deep ploughing or hoeing, as more

or less roots will be broken. The vines on such land have to be removed often. The best mode is to make layers, whenever a vine shows want of vigor or productiveness. The object here is, not to raise many plants, but only one or two, to take the places of such worn out vines as are left growing in the same trench where they have been put to strike roots when the old one is cut off. This mode applies also to old vineyards where the tap-roots are decaying, and where there are not sufficient tap-roots to support the vine. The root culture was well understood by the Romans, and practiced much the same then as now. Columella observes that the roots of the vine should be cut off as low as eighteen inches from the surface to prevent their drawing the plant too near and along the top soil, of which he mentions all the destructive consequences. He recommends the fall as the season for performing this operation, which, however practicable it may be for a genial climate like Italy, would be most injurious to the vine where a cold winter prevails. Another chance to regulate the growth of sound roots occurs when they are manured. In digging the trenches for the manure a great many are cut through, and will then grow more vigorously in the freshly enriched soil. When a vineyard has had thus far all the care and intelligent management, it may, nevertheless, be blighted and rendered unproductive by frost. Happily it does not often occur, else the grape culture would not have flourished from the oldest times until the present day.

The grape-vine is exposed to winter and late spring frosts. The former may be general, or may occur only in certain localities, and, even then, destroy but single canes and eyes. It must be extremely cold when whole vineyards are frozen dead; but partial freezing is not so rare. Sudden changes from mild to severe cold weather, (especially towards the spring,) then sudden heavy frosts, after rain, which covers the vine with ice, or if the vineyard is exposed to high prevailing north winds, all these may cause damage to the vine. These calamities, will, however, affect the vine less if its wood has perfectly ripened the previous season, otherwise they may cause considerable destruction. In localities where the winters are severe the surest preventive is to lay the vines down in the fall, before the frost comes. In less exposed vineyards it is well to cut the vines loose, so that they may shake off ice or rain, and thus get rid of it before it can do any damage. It is still worse, however, to bend the vines down, and by stones to hold the young branches or canes in such a position. The bark and often the cane will thus be broken, and such a wound made the means of destroying the pit and buds. Lazy or inexperienced vine-dressers sometimes try such means, so that they may say they have done something towards the protection of their vineyards. But the old and wise rule—"let things alone that you do not understand," is applicable here as well as elsewhere. More destruction to the vineyard, and more discouragement to the vine-dresser, is caused by late spring frosts. These will occur mostly when the grape-vine has developed, and has set its much promising fruit. As long as the buds and young shoots are covered with the downy substance with which nature has kindly provided them, they can bear a slight frost without danger; and even if, by a sharp frost, they should be killed, there are still the leaf-buds left unharmed, and they will, in the most cases, become strong enough to make good wood and bear some fruit. There are several ways and means to prevent such effects of frost, or at least to make the frosts less destructive.

In localities which are more subject to these late frosts the vines should be kept back as long as possible in the spring by keeping them down and covered, and then letting them hang loose until the buds burst out, before tying them to the trellis or stake. The ground, also, should not be stirred till late. Another preventative, and one that is here and there practiced, is smoking. This is the most efficient method. The old Romans found smoking the only sure means to check the frost from doing damage to their vineyards and lemon plantations, and it still proves to be the best remedy. There are many cheap materials fit for

smoking, but the best are peat, dry turf, and tan. Whichever of these are handiest should be kept in the vineyard, ready for use at any time through spring or fall. If any danger appears they must be scattered in little heaps all round the vineyard, and especially a good supply put on the side where the sun first strikes the vineyard in the morning. These little heaps will smoke better if covered with one inch or more of earth, and will also last much longer.

Having everything ready for smoking, the slightest indication of frost which may be observed in the evening should keep the vine-dresser on the alert to watch the temperature. If the thermometer falls down to a few degrees above the freezing point, and no wind or any motion of the air appears, it is time to ignite these heaps to raise a smoke. It will facilitate the operation very much if the heaps are dampened occasionally by sprinkling water over them from a watering pot. The smoke must be extensive and intense; it will then not only warm the air but also form a light cover over the vines to prevent the hasty evaporation, and operate very much as a cloudy sky. Then in the morning, when the sun rises, it is best to moderate the rays from shining too intensely on these chilled sprouts. Where there are large tracts of vineyards near together it would be profitable for their owners to join in this operation; it would thus not only be more effectual but would lessen the labor and save considerable fuel. There is another method, introduced by Mons. Suard, of Corbigny, France. He advises to take straw, or shavings of pitch pine, and make a kind of torch by twisting a portion of it together, about the thickness of an arm, three or four feet in length, then tie it with willow twigs. One person will need five or six such torches at a time to tend the vines on one-fourth of an acre. The supply and attendants must correspond with the size of the vineyard. In a frosty night, then, the men are started out to ignite their torches and to walk up and down the rows, keeping the torches close to the ground and the vines, so as to smoke them thoroughly, and continue until the sun takes their place. It will be seen that here the direct, artificial heat is more powerful than the smoke. And, as this is not as lasting, it has to be repeated oftener, and is, therefore, not so well adapted to large vineyards, where it would be, on account of requiring so much labor, rather expensive.

After having given an outline view of the different labors of the vineyard, from the propagation of the vine to its coming into bearing maturity, it may be proper to dwell a moment upon the treatment of the soil. This is of great consequence in successful grape culture, as it has a direct influence upon the quality and quantity of the fruit.

The objects of the tillage of the vineyard are: 1st, the breaking of the soil, in order that heat, light, and air may penetrate, to decompose the vegetable matter and make it fit food for the vine; 2d, the destroying of the fibres or dew-roots, which would otherwise impart a bad flavor and taste to the fruit; 3d, the destroying of weeds.

The best time to commence stirring the soil is in the spring, when the danger of frost is past; then the warm atmosphere penetrating the soil will greatly assist the vine in its development. It will be very dangerous for the roots if the ground is loosened shortly before the approach of winter, as the soil will be charged to extreme with water, and this, accumulating ice around the roots, or at least chilling them, renders them unfit to support the plant. As the ground will have to be stirred several times through the season, it should always be done soon after a rain, though not before the vines are dry, as breakages could scarcely fail to occur when many of the shoots are bent down with the weight of water. Again, all work and tending has to be stopped while the vines are in bloom, and not resumed until the fruit has set. In regard to destroying fibres and dew-roots there will be many necessary modifications to be made and deep or shallow tillages required. It has already been mentioned that, in naturally deep soils, the roots should be encouraged to go down into the sub-

soil, while in soils of a cold, wet nature they have to find their subsistence in the top soil. The tillage must, therefore, be adapted to the texture of the soil. In the former case, the vine will be benefited by deep tillage and by breaking off its top roots; but, in the latter, a shallow stirring and a protection of such roots will be advisable. While a good soil may be worked almost any time during the summer, less desirable land should be neither ploughed nor hoed when it is wet or very dry, even if at such periods a prolific crop of weeds should appear. Whether a vineyard should be ploughed or hoed often depends, again, upon the nature of the soil. Light soils and those of the best quality need less culture; but those that are bound, cold, and wet require much more stirring, especially as in such land the weeds are predominant. The work itself may be performed by horses or hands, according to circumstances. The application of either must be left to the judgment of the proprietor. In both cases, a light one-horse plough, with a steel point, and the grape-hoe are the best and most efficient instruments with which to do the work.

When a vineyard has successfully produced crops for a length of time, it will need more or less assistance to produce subsequent full crops and to prevent its total exhaustion; in other words, it requires manure. Which of the many different kinds are best to be applied is a matter of great importance. In southern climates vines will thrive well with less substantial food, and even green manure may be sufficient; but further north the grape-vine requires a more careful culture and a larger quantity of nourishment. The best material for green manure consists of the whole family of leguminous plants, which are *sown in the vineyard in the spring* after the vines have been tied up. After blooming, before the kernel hardens, they are turned under the ground, and thus, by decomposition, will form food for the grape-vine. Among the best varieties for such purposes may be named the lupines, peas, vetches, and lentils.

In order to comply with the wants or nourishment of a grape-vine in a northern zone it seems necessary to understand the composition of the grape-vine itself. Besides the usual volatile substances, it is principally composed of lime, magnesia, alkali, and phosphoric acid. Lime and alkali may be applied, without any animal manure, in the shape of marl or wood ashes, while magnesia and phosphoric acid are contained in the manure. It being important, in regard to the wine, that too strong an action of ammonia on the soil should be avoided, the best period for manuring vineyards is in the fall after gathering the grapes. The following may be considered as the more important fertilizers employed in the cultivation of the vine: 1st. Cattle manure mixed with litter. The animal excrements, without litter, seem less adapted to the vineyards because they decompose too fast, either injuring the wine or causing a great deal of the fertilizing substance to escape.

The chemical action being greater in the vineyards, owing to their heat, than in other fields, it is desirable that there should be a slower process of decomposition, which is effected through the litter. The vine is supplied with a vigorous nourishment for a longer time, while its fruits are not filled with substances afterwards injuring the formation of the wine. The following kinds of litter are particularly adapted to the preparation of the different kinds of manure employed in the cultivation of the vine:

1. The straw of the cereals, especially that of barley and oats, because it contains the greatest amount of alkali, while there is no great difference in its fibre from that of other kinds of straw.

2. The straw of beans, especially useful on account of its considerable amount of alkali, though the manure requires a much longer time to rot.

3. Buckwheat straw, and the straw of peas, vetches, and potatoes, is inferior in value to the above.

For the grape-vine, cattle manure ranks first. It does not decompose so rapidly as other kinds of manure; its action, therefore, lasts longer without

provoking a sudden growth. Of all the animal excrements it contains the least quantity of nitrogen, and therefore becomes less injurious to the wine. Horse and sheep manure, on account of their considerable amount of nitrogen, are injurious to the wine and of little advantage to the grape-vine itself, as a large portion of their constituent parts is not assimilated by it. These manures can be employed only when entirely rotten, in which condition the application would prove, comparatively, too expensive; because, if applied to other purposes, all of its constituent parts would operate upon the plant without permitting any part to escape. These manures, however, as shown elsewhere, may, by being covered with earth on the dunghill or in the sheepfold, be deprived of their injurious effect upon the cultivation of the vine, and thus rendered but little inferior to cattle manure.

Hog manure should be avoided on account of the disagreeable taste which it imparts to the wine. It can be employed only when entirely rotten, or in very small quantities mixed with other manure. The dung-water consists of the urine gathered from the domestic animals, and the fluid parts extracted by the rain from their solid excrements. Owing to its large amount of ammonia it was formerly disliked as a manure for the grape-vine; but for several years we have been applying it with the best of success, especially on poor and hot localities, where the various constituent parts are dissolved, probably, by the amount of ammonia. Those places on which yellow vines have been accustomed to grow show none of them now. The fertility of the vines having increased the grapes themselves no longer perish, as was formerly the case. The precaution, however, is given of applying the dung-water during the winter months, although, if applied during a rain, experiments have shown that it has no injurious effect in summer. From two to four quarts of it are put into small ditches behind the vines and covered with the earth that had been thrown out. Dung-water may also be advantageously used in the preparation of compost for the grape-vine Manure from poultry, especially from chickens, is, from its amount of nitrogen, less applicable to the cultivation of the vine. Still less adapted are the human excrements, owing to their amount of nitrogen; this, if no other reason, would prohibit its application to the vine. Animal substances, such as wool, hair, claws, horn shavings, &c., are sometimes used as fertilizers for the grape-vine Because of their amount of nitrogen, however, they are not well adapted to it; besides, some of the essential elements are wanting in such substances. D. T. Liebig refers to a case in which a vineyard, at first very powerfully and steadily manured with horn shavings, suddenly deteriorated, because there had been no alkali contained in the horn shavings, while vineyards receiving stable manure were kept in vigor for centuries, by substituting the largest quantities of the various constituent parts. Bones and bone-black from the sugar refineries are well adapted, because of the lime and alkali which they contain. Husks and crests of grapes are excellent fertilizers for grapes, owing to their amount of alkali, but they will have a full effect only when used fresh. Lime, being a component part of the grape-vine, must be present in every soil in which the vine is intended to grow vigorously. After the amount found in the soil is consumed, a fresh supply is absolutely necessary to the growth of the plant. Dressing with lime, it is best to mix it unslaked with moist earth, and let it crumble. The earth and lime thus mixed should be thinly scattered over the surface of the vineyard in dry weather, without bringing it into contact with the leaves.

Sand either acts mechanically, by separating or dividing the particles of earth sticking closely together—this being one of the most important means of improving heavy clay soils—or it acts actually as a fertilizer, inasmuch as its grains consist of substances which are applied when dissolved, as mica, feldspar, lime, &c. A soil deficient in these substances can easily be improved by the application of sand made from them; in other respects, too, the application of sand refreshes the soil, divides its parts, and will always have a favorable

result. A similar effect is attributed to the application of earth, especially turf earth, which, besides its own constituent parts, contains also a considerable amount of substances from the formation of humus. The more varied the composition of the earth the better it is. Soil taken from the forest and mixed with the debris of granite is, perhaps, the most suitable of all. As ashes derive their fertilizing power only from the mineral salts contained in them, it is evident that their effect differs according to the plant and the soil to which they are applied. Some ashes contain alkali, while others have none; and as it is probable that the great amount of alkali contained in the grape-vine requires also a large amount of it in the soil, those ashes only which contain the greatest quantities of alkali will have effect upon the vineyards—for instance, wood ashes, especially those from the beech. It is hardly necessary to say, however, that they must not be cleared of their ley before being used. In order to apply the ashes uniformly they should be mixed with the manure, or scattered over it, when put into ditches. To scatter the ashes on the surface without mixing them at once with the soil may not be found profitable, as in sloping localities they may be washed off by the rain before being absorbed by the soil. In certain cases small quantities of potash may be scattered over the manure or in the ditches. Soap ashes usually contain much lime of a caustic nature, and also some other mineral fertilizers, if wood ashes and kitchen salt have been employed in the manufacture.

Compost, if not mixed with substances obnoxious to the grape-vine, seems to be the most suitable fertilizer, because it is deprived of all volatile, ammoniacal substances through the previous fermentation, by its long exposure, and by its being stirred about, while the other substances are being so dissolved that they can easily be absorbed by the grape-vine. Animal and vegetable offal, turf, ashes, sod, &c., are the best materials for compost. They should be put in layers, one upon another, and the whole covered with earth. In case the heap becomes too dry, it should be moistened, so as to cause a proper fermentation. Urine of animals can suitably be used for that purpose, as there will be sufficient time to let its ammonia escape. In the absence of animal offal, the compost heap may be made of layers of vegetable substances and earth. These compost heaps may be left for a year in the place where they are formed; all they require is an occasional sprinkling and stirring about. Fresh lime promotes the decomposition very much, but it destroys many fertilizing substances.

WINE-MAKING.

When in a favorable season the grape-vine has been properly attended, the vineyard will be at the end of the season adorned with luscious fruit, plentifully rewarding all the labor and expense. Busy hands are then making preparation for the last and most essential work—that of gathering the fruit. Cellar, wine-press, casks, and the whole apparatus will have to be overhauled, and got in the best condition. It is, in fact, the busiest time for both cooper and vine-dresser, because the success in wine-making depends a great deal upon having everything ready at the time when the grapes are fit to be gathered. In regard to the proper time when they should be gathered, it must be ascertained by examining both vine and fruit. When the grape-vine begins to show less vigor in making wood, and the nourishment of the fruit from the soil ceases; when the clusters hang down heavy; when their stems become hard, woody, and colored, like those of the young, ripe shoots; when the juice of the fruit has attained its peculiar vinous taste—when its saccharine substances predominate, and the sharp acidity is changed to a mild, pleasant taste—*then* it is a suitable time to gather the fruit. If the weather permits the grapes should be left ripening on the vines till late; the riper they are the better the wine will be; a slight frost will not hurt them, but will in most cases be beneficial. It is

very important to provide proper means for gathering and transporting the grapes to the wine-press. Every instrument and vessel that is used for this purpose must be clean and sweet; the least particle of foreign substance will impart its flavor to the wine, and in the most cases have an injurious effect. For receiving the grapes, when they are cut off from the vines, a wooden pail made of white oak is the best for that purpose; then have another larger tub in which to empty the grapes. This tub should be but a little wider than the pail, but about three feet high, with straps, so that a man can carry it on his back either directly to the wine-house or to the wagon. When the grapes have to be transported a considerable distance, it is best to carry them in substantial tubs, each holding about five hundred pounds, with covers to keep off the air and wet. These tubs should never be used for other purposes, but always kept perfectly clean. It is a very bad practice in this country to use for the transportation of the grape everything that comes handy, from old musty shoe boxes down to the swill barrel. So long as there is no more regard paid to this very important point wine-making will be a failure. Even so, so long as the noble *wine* is placed upon the degrading level with *cider*, which is nothing but a liquid fit for vinegar. When the grapes are ripe enough to be gathered sufficient help should be procured to perform the work in the least possible time; nor should they be gathered in damp or rainy weather, or in the morning until after the dew is off and they are perfectly dry. It has been observed by Chaptal that grapes gathered in damp weather would make twenty-five instead of twenty-four casks of wine; but how much more watery they will be if gathered in rainy days! Such wet grapes, no matter how ripe they may be, are a poor material from which to make good wine. Such grapes will, in most cases, rot before they can be worked off, and will impart a flat, bitter taste to the wine. Should it be decided to make different qualities of wine, the grapes have to be sorted when gathered; the ripest and best collected first to make a first-class wine of, and the remainder to make a common drinking wine. The same assortment is necessary for the manufacture of claret or white wine. For making the so-called "cabinet wines" only the very ripest grapes are chosen. The next utensil for making wine is a grape-mill, where the grapes are mashed. The construction of these mills is very different. As they have been in use but a short time they are not yet *perfect* in their construction. A good grape-mill should have an apparatus attached for separating the berries from the stems, if desired, before they are mashed, and also for throwing them out. It is to be expected that some ingenious mechanic will yet construct a grape-mill that will be perfectly complete in all its parts, and that will serve for every purpose. In inferior vintages, if the stems could be conveniently separated and kept out from the mash, the wine would be far less charged with these astringent substances—tannin, vegetable acids, &c. The mill we use in our establishment for mashing the grapes is a well-constructed combined cider-mill, with a little press attached, and sold by Hitchcock, of Boston, for $45; it works well. We have mashed, without extra exertion, two thousand pounds in one hour, and sometimes from eight thousand to ten thousand pounds in one run, which is the capacity of one of our fermenting vats. The function of the grape-mill is to break the skin and pulp of the berry, but not to rub or grind the seed, which would have a most injurious effect upon the wine. In some cases, when the grapes have been gathered in cold weather, it may be advisable to let them stand in large tubs a day or two before mashing, so that they may be warmed, until they have arrived at that temperature which is best adapted to the fermentation of the must, which would otherwise have to be done. When the grapes have been mashed, the next process is to separate the must from the pulp and skins. This may be done either by putting the mashed grapes under the press at once, or by drawing off the juice, and using the remaining parts for distilling brandy; or the must may be drawn off, the juice pressed out of the husks, and both put

together into casks to ferment. The old Romans, well acquainted with the manufacture of wine, would use only the juice obtained by mashing the grapes. The husks were put into vats, and, charging them with water enough to ferment, the wine thus obtained was given to their slaves.

The wine-press of modern construction is little known even yet in southern countries of Europe; but in the north, where the grape culture flourishes, and the wine has been made an article of trade and export, it is an indispensable apparatus. The management of the mashed grapes depends altogether upon the wine which is to be made of them. If white wine is desired to be made, the must is drawn off from the vat in which the grapes were mashed, and put into casks in the cellar to ferment. The remaining part may then be used for distilling brandy, or it may be charged with water, in which a sufficient amount of sugar has been dissolved, to bring such a solution up to the standard of the extracted must, which had been previously ascertained on the must-scale. In order to bring the sugar into contact with every particle of these husks, the solution has to be drawn off and put back several times, when the whole is then left to ferment. As the color of the grape (which color is contained in the skin) is extracted by fermentation, such wine will be more or less colored. It is generally called "Shiller wine." Sometimes, and in some districts, the grapes are mashed in the press; the first run of the must is not kept separate, but is mixed with the press must, or with the juice obtained from the press, and then fermented together. If colored grapes have been used, the wine will be neither red nor white, and is therefore called a Shiller wine also. Before proceeding any further, it is proper to state what is required to contain the wine. The best wine will be spoiled if put into poor casks, and poor wine will be improved by being put into good casks. The best wood for making casks is white oak. Its large proportion of tannin, which is injurious to the wine, should be extracted from the wood before the casks are made. In our practice here we found steam the best agent for that purpose. It was desired to have large store casks made, but the staves had to be got directly from the forest, and were consequently green. Our steam-still, with a boiler of five horse-power, did the work thoroughly; so that within less than nine months the trees were felled, the staves got out—made into casks of from 1,400 to 1,500 gallons capacity, and these filled with wine. It is necessary that such newly made casks, before they are used, should be salted, soaked with cold water, and finally well sulphured. In countries where oak wood is scarce softer wood is used for casks—such as chestnut, larch, or even spruce; but as their wood is very porous, it should never be used where oak can be obtained. The wine in such casks loses much in quantity by evaporation, and seems to be more easily affected by changes in the atmosphere.

In regard to the size of a wine-cask, it has been proved that the larger the cask, and the more wine there is put together, the better and more thorough will be its fermentation; the wine will require a longer time, but there will not be so great a loss by evaporation. Then, too, large casks will economize room in the cellar, which is very important, as wine vaults are expensive structures. The young wine, by going through the process of fermentation, is greatly reduced in quantity. As those vegetable substances, of which the grape juice or must contains large portions, become separated and settled at the bottom of the cask, they have to be taken out when the wine is drawn off; therefore the other casks into which wine has been transferred will be minus their quantity. It is, therefore, necessary to have casks of less capacity also; and as wine casks have always to be kept full up to the bung, smaller casks are indispensable. The utmost cleanliness must be observed in the cellar and casks. When a cask has been emptied, it should be washed at once, before it gets mouldy, then well sulphured and bunged up. Should this be neglected a fungus will soon appear, and grow rapidly all over it. This will either make the cask wholly unfit to put wine in again,

or it will require considerable labor to clean it. In such cases one head has to be taken out, strong lime-water put in, and left for several days; then this has to be taken out and the cask washed clean with cold water; after this the head is put in, then water is boiled, in which salt, leaves of the walnut or hickory tree, and juniper berries are thrown in, when the cask is washed again with this hot decoction, and then sulphured, after which it is bunged up.

Another method of cleaning mouldy or sour casks is to burn them out with straw. Use alternately strong lime-water and clean cold water from the well for washing them; then sulphur and bung them up. As wine-casks are generally and *should* be iron bound, the hoops will, more or less, corrode, and if not attended to they will burst. The hoops need cleaning as well as the wooden part. An occasional application of raw olive oil will be found very beneficial for them. In the manufacture of wine there is also a good cellar required, in which an even temperature can be maintained. It is evident that common built cellars, on account of their being constructed of materials incapable of resisting heat and cold, are not well qualified for containing wine. A wine cellar must be built of stones and arched overhead. It should be neither too dry nor yet damp, and well ventilated. The temperature in a wine cellar should never be below 50 degrees in the coldest weather, and never above 60 degrees in the summer season. It should be plastered and whitewashed once every year; its bottom flagged or at least cemented. The casks must be placed on strong timber raised up from the floor about eighteen inches by means of blocks; each cask must have four keys to keep it steady in its place. Not less important in making wine is a good strong press. Those of modern construction are composed of an oak platform, made of timber about one foot thick, and excavated from four to six inches; this forms the bed. Then planks are set up, making a box into which the mashed grapes or husks are put; again planks are used for a basis for the cross timbers, and, lastly, of an iron screw. For an illustration of what size a press of a certain capacity should be, we will give the dimensions of ours, which works admirably well, and with which we have several times pressed 10,000 pounds of grapes at once. Its construction is the same as that already stated. The excavated platform is four inches deep and six by eight feet wide; the oak planks are two inches thick and the cross timbers six by eight; the screw is five inches thick and seven feet in length, with ratchet wheel and short iron lever, to which another lever of wood is attached, the whole costing about $150.

Having already stated the process of making white wine, we will now explain the manner of making claret wine. It is in France that the most claret wine is manufactured. According to Lenoir, an eminent wine maker, the claret wine in France is made as follows: The grapes selected for that purpose are mashed in large vats made of wood or masonry, of a size which will contain 1,200 gallons or more. When one of them is filled, a cover, made of boards, is put over it, and the whole, juice and husks, left to ferment. As the husks will rise to the top they are pressed down once or twice during the day with a piece of board shaped to suit the purpose. A temperature of about 60 degrees is maintained as long as the fermentation continues. Should the weather be cold when the grapes are gathered, the mash has to be warmed up to that point. The fermentation will last from fifteen to twenty days, when the wine is drawn off and put into casks in the cellar, where the process of fermentation continues until the wine is finished. The husks from which the liquid has been drawn off are put into the press, and the wine obtained by pressing them the second time is put into the cellar also, but is kept by itself and used as a common drink wine, as such wine is not considered marketable.

With some modifications, claret wine is made in the same way throughout all the wine-producing countries of Europe. Climate, quality of the grapes, and skilful management are the causes of so many variations in red or claret wines.

When we are ready and willing to cease from the mania of propagating anything in the shape of a grape-vine merely for the sake of having a large variety, we may find by careful examination some good material for making claret wine. Our climate and soil are as well adapted as any other. There is not the least reason why we should any longer import foreign articles when they can be manufactured here of the same, if not of superior quality, and as cheap as we buy them from Europe. If we consider the present consumption of wine in the United States alone, we shall feel encouraged to engage in the grape culture if only to supply our own wants. In the present generation we shall scarcely do more.

The manufacture of sparkling or champagne wine requires considerable more fixtures and apparatus, especially cellars of different temperature, as it is often found necessary to change the casks and bottles from one cellar to another when the temperature becomes either too high or too low, which, in either case, affects the development of the wine, and sometimes causes great loss. It always involves damages to wine and bottles, which, it seems, cannot be avoided, even with the utmost skill and care. White and black grapes are used for that purpose; such a mixture will add greatly to the quality of sparkling wines. Black grapes impart a more brilliant color, strength, and vinous flavor. Only the best and ripest grapes are selected, the green and dry berries being carefully picked out. They are kept cool by being covered, and carried to the press-house as fast as they are gathered. All bruising of the berries and whatever may cause fermentation is avoided. The mashing and pressing out of the juice must be performed with the greatest possible speed. The first run will make the best wine; the second, however, will be a little more highly colored, but it will be more spirited, and of a very agreeable taste. The product of the last pressing is not fit for sparkling wine, but will be found useful in improving common claret wines. The must thus obtained is put into vats, and remains there until its fibrous substances have separated. These substances will either settle at the bottom or rise on the top. In order to extract as much of them as possible, which causes too rapid fermentation, such must is drawn off several times from the vat, and when it begins to ferment it is again put into vats or casks, and taken into a cool cellar. The drawing has to be continued until the wine is clear, when it is bottled. It requires several men well skilled in the work for bottling the wine. To prevent sediment from getting into the bottles a piece of fine gauze is tied over the mouth of the faucet. The bottles are then filled up within about two inches of the top, well corked, and tightly secured with wire. The bottles are then placed in a horizontal position upon a frame made for that purpose. The bursting of bottles will be more frequent during the hot season, July and August, and the loss by breakage may be from ten to forty per cent. If the damage does not exceed ten per cent. no notice is taken; but when, as it sometimes happens, whole tiers burst, the bottles have to be removed to a cooler cellar, or to be opened, so that the accumulated carbonic gas may escape. With the approach of colder weather the danger is lessened. It is then necessary to examine them carefully, removing the broken and defective bottles, and place them neck downward, so that the sediment will settle on the cork. They have also to be taken up twice a day, without their position being changed, and gently struck with the palm of the hand, to bring their contents into motion. This operation will facilitate the separation of the mucous matter yet in the wine. After more or less sediment has collected on the cork the bottle has to be opened and this sediment let out. As soon as this has been accomplished the bottles are again filled and corked; fresh corks are used, and these tied up again with wire. They are then placed back upon the frame, in the same position as before. This operation has to be continued from time to time as long as any sediment appears upon the cork. Sometimes it is preferred to increase the sparkling qualities of the wine by adding sugar. Only the finest candy

sugar is used for that purpose. It is dissolved by being heated, clarified with the whites of eggs, and then filtered or strained. The sirup is finally partially dissolved again with wine, when it is fit for use. It is added to the wine in small quantities when the bottles are opened the first time. The manufacture of sparkling wine on a small scale, and without the necessary mashing apparatus for the management of the bottles, will not be found profitable; but should this method be adopted, the bottles (before they can be shaken, opened, and worked over) must be taken to a cool room, there exposed to a temperature of a few degrees above freezing, and after the operation has been performed taken again to the cellar. The manufacture of liquor wines in southern countries, especially in Spain, is carried to a considerable extent, and *might* be in our country also as well as not. California, New Mexico, and other southern States produce grapes of the same good quality. The manner of proceeding in those countries is as follows: the grapes remain on the vines until they are perfectly ripe and have become shrivelled, when they are mashed and slightly pressed; the must is put into shallow vessels, placed over a fire and heated until reduced about one-third by evaporation. During this process all the substances which rise to the top are skimmed off, and the must, after having been reduced by evaporation to this point, is put into vats to cool, and afterwards put into casks, in the cellar, to ferment. As in such wines the saccharine substances are predominant, while the acids are in very small quantities, these wines are always inclined to turn sour unless they are charged with alcohol. The high temperature in these countries, and the large quantities of undissolved sugar not fermented, have a dangerous effect upon these wines. They come into our markets as Port wine, Madeira, Malaga, &c., and are, for their sweetness, high flavor, and strength, much admired.

There are many other modes of making wine, which differ as widely from one another as the wines themselves, but the limited space here will not allow me to go further. We will attend next to the management of the wine in the cellar.

After the wine has passed through the first violent fermentation, all musculous and vegetable substances which the must contained will have settled down on the bottom of the cask; this sediment is called "lees." It is now time to separate the wine from these substances, in order to prevent after fermentation and to improve its quality. When the wine is getting clear, sometimes, in December or January, it is drawn off and put into another cask, which is filled up to the bung; this is driven in tightly, so as to exclude all external air. Before the weather becomes too warm, perhaps the latter part of March, the wine is generally drawn off the second time; it is then left undisturbed through the hot season, except that the cask is filled up once in two weeks. During the following winter it is drawn again, after which it ought to be clear and marketable if it has been carefully managed. The second year the wine may not require drawing more than once; this, however, depends upon how the wine has developed. Soft and tender wines should not be drawn but once, but wines of more or less roughness will be much improved by being drawn twice. Red or claret wines are left longer on the lees, and sometimes not drawn until the next fall. It has been said that the casks should always be kept full up to the bung; but sometimes in the hot season, when the temperature rises in the cellar also, the wine will become to some extent agitated and expanded; it is then necessary to draw some out of the cask to prevent its bursting. For filling up the casks wine of an inferior quality should never be used; the wine from the same vintage is the best adapted for this purpose. If it is not desired to tap a large full cask for the purpose of refilling others, some smaller casks of old wine may be conveniently used with the same good result. But if *wines* cannot well be spared, *stones* may be used; quartz or flint stones are the most suitable. They are washed and kept ready for use. When the cask needs filling up a portion is thrown in at the bung hole. This operation is continued until the object is ob-

tained. Another important point in keeping the wine in good order is the use of good bungs. These should be made of oak, so as to fit the hole very tightly, to prevent evaporation and excess of air; they should be soaked in olive oil before being used. When the wine has been well treated and rightly managed from the beginning, there will be no occasion for its becoming turbid and sour; but when, from ignorance, or carelessness, or from any cause which could not be provided against, some disturbance appears, no time should be lost in stopping its progress. The general cause of imperfections in wine consists in defective fermentation. With a high temperature of the atmosphere the undissolved portions of saccharine and vegetable substances will again commence to ferment, causing agitation to that which is already formed into wine, and finally resulting in a destructive decomposition. The only remedy for this decomposition is to control this process by artificial means; in other words, to stop such a violent after-fermentation. This is done by drawing off the wine into well sulphured casks, and cooling it by the application of ice, or wet blankets, on the outside of the casks. The blankets have to be soaked often in cold water. It will be found necessary to draw the wine off several times, and put it into fresh sulphured casks. The object is not, however, to stop the fermentation altogether, but to let it proceed slowly and effectually.

Another disease of the wine is its inclination to sour, which occurs when the grapes have been gathered before they were perfectly ripe. The large proportion of acids causes the wine to be thin and void of all tenable principles; malic acid will fast accumulate, and the wine will turn to vinegar. There is no better remedy for this than the method given by Dr. Gall for "improving inferior vintages, and making of unripe grapes a good drinkable wine." This method, however, has been so well treated in the last two preceding reports of the Patent Office that little or nothing remains to be added. By our own experience we have concluded that this method is one of the greatest and most efficient improvements in modern wine manufacture. It is at once encouraging to the grape culture in the northern climates, as it removes all doubts in regard to the possibility of obtaining a good wine from a northern product, and also opens a new lucrative branch of industry to a large number of intelligent men. The great difficulty now in having this method brought into general practice is the want of a uniform must-scale and acidmetre, both of these instruments being indispensable to successful operation. There are some must-scales now in use which have been imported from Germany, but as they are differently constructed they do not agree with one another, and are therefore useless for comparative observation. Combined instruments, which indicate the percentages of the different acids which the wine contains, vary still more, and are, in the most cases, not plain enough to be understood by the wine-maker, and are therefore of little use to him. As the construction of such standard instruments are too expensive for a single individual, they should be furnished by the government. A chemist thus employed would, by analyzing the grape juice, be enabled to arrive at a point from whence a standard scale might be constructed, and its manufacture performed by an able mechanic. As long as these instruments cannot be employed, wine-making will be only "guess-work," and less profitable than it would otherwise be.

Another very important matter, which, if also carried out by the government, would prove very beneficial to the grape culturist, is the distribution of Agricultural Reports. At present there are very few practical grape growers who ever saw such a document. If this cannot be done on account of the present system, in which, for the most part, only members of Congress have the privilege of disposing of, abstracts relating to that subject, if printed in pamphlet form and sent to horticultural and agricultural societies, would then reach the men who are engaged in this enterprise, and who would be really benefited by their perusal.

ON THE FRUITS OF CABUL AND VICINITY,

WITH A VIEW TO THE INTRODUCTION OF THE GRAPE-VINE OF THAT REGION INTO THE CENTRAL CLIMATE OF THE UNITED STATES.

BY JOSIAH HARLAN, OF PHILADELPHIA.

As an introduction to some remarks on the grape and other fruits of Cabul, the following letter, dated September 4, 1857, from myself to the Hon. Joseph Holt, former Commissioner of Patents, is properly prefixed:

"I observe by the public papers that you propose *experimenting* with grape culture by cuttings of our *native vines!* I believe this has already been effectually tried by Mr. Longworth, of Cincinnati, with a result that proves beyond peradventure the worthlessness of all such efforts I have several native vines growing on my mill-race bank, Chester county, near Cochransville, under most favorable culture, which show merely an improvement in the size of the fruit; none whatever in flavor, or modification of the tough pulp characteristic of all our *native* fruit They are the black or purple and the white species; a good article for preserves and marmalade, but do not approach the character of a tolerable table fruit in their present state.

"My object is to draw your attention to the introduction of cuttings from Cabul, a capital city of Khorassan. The success of this enterprise will enhance the wealth of our country infinitely beyond all the results heretofore contributed by agricultural experiments. It will also prove a blessing to our people by the development of habits of temperance, which we see are invariably prevalent in all wine-producing countries. The Cabul grape would place our country on a parallel with France, Spain, and Italy. For vine growing we have every variety of climate, including the isothermal lines of those countries. My opinion is based upon practical experience of the Cabul climate, and the atmospheric phenomena, which are quite similar in both countries. The vegetable productions of each would be alike familiar with either climate, so that a vine cutting taken from Cabul this winter would start with us on the opening of spring without recognizing a change of climate, and, after two years, become a bearer. I will not offer to elucidate this subject by scientific proofs, because I am not friendly to agricultural experiments based upon theory. In place of this, I will urge the experience of personal observation derived from several years' residence and familiar intercourse with the agriculturists of Cabul, which is the greatest grape-growing country in the world The chief use of the fruit is to make sirup from its expressed juice for common popular sweetening. The Mohammedans do not manufacture wine, but the few Jews and Christians *sub rosa* manipulate the grape in that way, and the best Madeira and Port are produced from the fruit of Cabul and of Bulkh, the Bactria of Q. Curtius. Similar fruit can be produced from Spain and the Levant, but the Cabul fruit is the only kind suitable for our purpose, in consequence of its native climate corresponding with certain latitudes of our own country, such, for instance, as eastern Pennsylvania, Delaware, Maryland, Virginia, and the Ohio valley, &c A view of the Cabul vegetable and fruit markets presents a sameness of products compared with our Philadelphia and Baltimore markets, familiar and refreshing to the eye of an American; and from this fact one is induced to fancy a similarity of climate and even of soil as the cause of such coincidence. The Cabul fruit, however, is vastly superior to any I have seen in Egypt, Greece, Italy, or France. The mountains of Cabul are clay slate formations, with granite and carbonate of lime. The *debris* of the valleys must consequently be similar to the soil of Chester county, exclusive of the Mica ridge, extending from the Schuylkill, west of Philadelphia, in the central counties of Chester and Lancaster. From this district a large portion of the fruit in our Philadelphia markets is supplied. The average temperature of a winter in Cabul is 20° above zero, Fahrenheit. Its latitude is about 36° north; longitude about 70° east from Greenwich; and its plateau is 6,000 feet above the level of the sea. The city is situated among the mountains within the great Caucasian range. At a still higher altitude, where the inhabitants are found of the fairest European complexion, having light hair and blue eyes, known to the Mohammedans as Caffres, and supposed by some historians to be descendants of Alexander, the great colonist, the grape grows to a larger size and of a more

luscious flavor, notwithstanding a great increase of cold and more general prevalence of lasting snows. The wild olive does not grow in the vicinity of Cabul. The forest trees are oak, pine, chestnut, plane, English walnut, &c., the last not being found in the immediate vicinity of the city, except in protected localities, just as we find it in some instances near Philadelphia. The spring frosts are frequently sufficient to destroy or to injure the almond blossom at Djillalabad, which is near to Cabul, but on a plateau far below in altitude early autumn grapes are produced and brought to the Cabul market long before the vintage commences there. They are not suitable for wine, but are a most refreshing table fruit. In this district of Djillalabad the wild olive and also the wild almond thrive in the forest, the fruit being worthless As the elevation of the plateau above the level of the sea is decreased, proceeding towards the river Indus, the wild olive tree becomes scrubby and unsightly, resembling our familiar laurel, and prevails abundantly, but not in the plain or level country east of the Indus. The climate of Djillalabad is similar to that of Italy. Ice but rarely forms. At Cabul the cold and the climatology and the duration of winter forcibly remind one of the same phenomena at Philadelphia. I have seen large bowers of grape-vines, pendant with the finest and most delicious fruit, that had been left suspended as the best means of keeping the grapes, when intended for daily gathering, conditioned for market. I related this fact to the venerable and celebrated Mr. Wadsworth, of Genesee, who remarked, 'The statement is so completely at variance with the convictions of our experience, that, except for your personal relation, I could not be induced to believe the story.' Such has been the impression of my auditors when the fact was urged in social intercourse; and, supposing the government would be no less incredulous than individuals, I have heretofore for the most part abstained from any public demonstration of my views. The business of grape culture in Cabul, to which I have given considerable attention, will be specially alluded to in a paper which I propose to present to the Patent Office, [the same which follows this letter.] I would respectfully suggest to the honorable Commissioner that means exist, through my intended proffer of service, by which the United States may readily and speedily become a great wine-producing country without going into trivial, doubtful, and unnecessary experimental efforts, already proven worse than useless. I propose to you an unquestionable enterprise, worthy your ambition for honorable and patriotic fame, and by which you may achieve an enduring celebrity. If you have sufficient pecuniary means at your disposal to pay the expense incident to this enterprise of attempting the acclimation here of the Cabul wine stock, and those of Caffreistaun and Bulkh, and of Kandhar, as well as other valuable fruits from those countries, quite a variety of delicious grapes may be procured, all of which are abundantly grown there in great perfection. You will readily comprehend, after perusing the accompanying report, that this project can only be accomplished by employing an experienced agent, understanding the language and acquainted with the manners and customs of the people. I propose myself to perform the duties of a special agent for this occasion, and hopefully refer you to this report to strengthen my claim to the patronage of your department. To naturalize the proper vines for all the purposes of commerce in this country would be adding millions of property to the wealth of our population. It would reform the national morals, extend immeasurably our commerce, and serve to pay off our debt to other nations, while enabling us to meet our increasing future imports, in place of remitting gold for the purpose. We should thus keep the gold of California at home, and avoid the chief cause of money excitements. In short, another discovery equivalent to California would not surpass, if it equalled, the inconceivable national advantages to arise from the commercial value of a naturalized grape culture."

In the spirit of the foregoing letter, I append the following pages on—

THE CLIMATE AND FRUITS OF CABUL,

so often mentioned by the imaginative and historical writers of Persia, which were at the season (August) which I have now in mind displaying so much of their beauty and perfection. The mild, salubrious atmosphere of this favored district, its high fertility and floral and pomonal richness, have won for it from the enthusiastic lovers of nature the title of "Ta-je-i-Zemeen," the Crown of the Earth! And truly it is worth the glowing language of *Moore*, in the *Veiled Prophet:*

> "And O! if there be an elysium on earth,
> It is this! It is this!"

Cabul is secluded from the world by the vast and intricate range of mountains constituting the Caucasian region of Central Asia. Numberless productive valleys, rich with the treasures of a fertile soil, penetrate the Alpine

ranges on every side, most generally responding to the labors of man in their abundant agricultural wealth, and gratifying the senses with the songs of birds, the bright hues of a thousand blossoms, and an odor-loaded air, unrivalled by any other spot in any land. The plateau on which the city stands is elevated six thousand feet above the level of the ocean. Its latitude is about 36° north, and longitude 70° west, of Greenwich. Towards the north, ascending by steep acclivities, the black rocks which characterize the Caucasian ranges form a barrier, rising to a height exceeding eighteen thousand feet. Above the elevation of eleven thousand feet the surface is covered with perpetual snow, and during eight months in the year the whole of the elevated region is clad in the livery of winter. The mural heights and bastion-like peaks stand forth in strong relief, enveloped in their spotless robes, and based upon their pedestal of soilless rocks, between which, in the deep and rugged dells, the first glance of the summer sun awakens, in startling contrast with the rude sterility around, the splendor of a most luxurious vegetation. The awful solemnity of the desert-frown seems somewhat to relax over the dancing joyousness of silver streams and emerald gardens glowing beneath a sapphire sky; and there the inhabitants, idling in the fullness of rustic wealth, employ their leisure in favorite rural pastimes. The voice of music floats upon the air; the solitary shepherd, guarding his flock upon the mountain skirt, pipes his wild notes in response to the skylark and nightingale. The heat of summer is tempered by the surrounding snows; a bland, serene repose in the soft sunshine steals over the senses, which is likened by the natives to the feeling of rest and comfort that follows a cooling sedative when applied to an irritated wound—an idea tersely and almost literally expressed in the Persian sentence: "*Aftab missil-i-merhum b'sir-i-adem mey ufted.*" Soon after the snow disappears, about the first of April, the fruiterers of Cabul commence their busy season by the sale of "falooda." This is a jelly prepared from the farina of wheat, similar to "*blanc mange.*" It is exhibited upon the stalls of their shops in large round trays of tinned copper, a mound of snow being placed on a corner of the stall. Customers are served with the refreshment, accompanied with sherbet or grape sirup, and a quantity of snow is scraped into it. As the season advances the fruits of the country are brought to market in vast quantities, furnishing a very delectable repast at very cheap rates, and affording, by their transportation, remunerative employment to numbers of poor carriers, donkey-drivers, and porters.

The people preserve many vegetables, similar to our own, throughout the winter, and with them, as with us, the appearance of the rhubarb stalks marks the advent of spring. The wild rhubarb grows luxuriantly upon the low hills about Cabul, and is brought to the city under the name of *Rewash*. The districts producing this plant are apportioned among the villagers under rights of common; and as the natives find that it cannot be cultivated to advantage in gardens, contested rights on this subject sometimes give rise to deadly feuds among the claimants, for the *rewash* is a vegetable in great request. The mode of blanching the plant consists in piling hillocks of gravel around the sprout, as it breaks from the earth upon the native hills. By continuing this process, the plant is made to grow to the thickness of the wrist almost colorless, with a slight tint of carnation near the root, and to the height of eighteen or twenty inches. This plan, and the proper method of preventing the expansion of the leaves, which would render the plant stringy, are well known to American kitchen gardeners. Another process of blanching, less practiced with us, is to cover the sprout with an earthen jar, to exclude all light. It then curls itself spirally within the jar, and becomes quite white, crisp, and free from fibre. It is eaten in its raw state with salt or sugar, and also makes a favorite preserve. Soon after the appearance of *rewash*, the market becomes stocked with a variety of vegetables similar to our own, and in great abundance, such as the tomato, egg-plant, parsnip, spinach, radish, of mammoth size, turnip, cabbage, cauliflower,

hot grasses, peppers, red and green, &c. The lime and the orange will not grow here; these and the wine grape in perfection will not thrive in the same climate.

The first fruit in the market is the white seedless mulberry, or *Shah-toot*, the royal mulberry. This is from two to two and a half inches long, and nearly the thickness of the small finger. It is very sweet, and the tree is inexhaustibly prolific. In its season it forms the chief food of the poor. They have the oval-shaped black fruit, and another of a blueish white pulp of the same form; the black is slightly acid; the latter is sweetish, but watery. The *Shah-toot* is a grafted fruit; of the others I am doubtful. The leaves of all these different species of the mulberry tree feed silk-worms, silk being a staple of the country.

Cherries, apricots, plums, and peaches, are supplied in vast profusion and in multiplied varieties. Of the cherry there are two kinds—the red and the liver-colored. The former is similar to our mayduké; the latter is a sour fruit, introduced from Tartary, and is used for drying and preserving, for which purpose it is previously stoned; it then proves a pleasant refreshment. The apricot forms an extensive family, of which the best grafted kinds are cultivated. These take their titles from the localities whence they are derived, or give immortality to the name of some agricultural benefactor or man of taste, to whom they owe their introduction. Thus the Emperor Baber, whose tomb is in the garden near Cabul known by his name, retained a strong affection for the land of his nativity, the principality of Kokund, in Northern Tartary; and to his genuine patriotism Cabul is indebted for the possession of several valuable fruits. The apricot grows spontaneously in the mountains, but the indigenous tree bears a yellow, acid, and inferior fruit. Of the apricot there are five species cultivated in Cabul, all delicious, but not equal in quality. There is one which, I think, is called *Ibraheem-Rhaney*, more especially luscious, which requires careful manipulation in the gathering. To prevent it from being crushed, the fruit is taken from the tree in a scoop net when perfectly mature. The weight is from one to one and a half ounce; it is white one-half and the other a deep blush. Should one fall to the ground its shape is destroyed, (so delicate is the pulp,) leaving only the seed and a transparent disorganized mass. There is no fruit with which I can compare this species to illustrate its exquisite flavor. It constitutes a very light food, of which a great quantity may be consumed at one repast. Many persons breakfast upon it, carefully abstaining from meat until the succeeding meal.

Of the plum there are also several varieties: the egg plum, blue prune plum, greengage, &c. Later in the season, about the end of September, grapes, cantaloupes, and watermelons make their appearance. Of the first, Cabul is supplied with the *Ungoor-i-Husseinee*, an oval, transparent grape; a red grape, so called, of similar shape and of the same denomination, but larger; these two species, especially the first, are largely exported by caravans, chiefly to India; the *Aryhaun-Kush*, which is a large, round, white, transparent grape, not much valued; and the *Ungoor-i-Kishmishee*, a fruit not large, round, transparent, with a slight tinge of yellow, seedless, sweet and luscious; this is a superior wine grape; the bunches are very long, and the berries are suspended by long foot-stalks; the first and last named, for the table and for commerce, being, in my opinion, infinitely superior to the best grapes of Spain, Smyrna, Sicily, or Italy. There is also a sweet, blue, table grape received from Djillalabad, a temperate climate, where snow does not lie and ice is rarely formed; it is brought to market with the mulberry of Cabul. This being a Mohammedan country, the manufacture of wine is not allowed, the use of it being proscribed by their religion. A few Armenian Christians and Jews, resident there, furtively make a fine wine of the *Ungoor-i-Kishmishee*. In body, flavor, and keeping qualities this wine cannot be surpassed. The commonest use made of the sweet grape is to produce a sirup for cheap sweetening, in place of sugar or molasses. Grapes are said to cause fever if eaten before the autumnal equinox. They are exposed

for sale in vast quantities, however, from the time when the juice becomes sharply acid; then the immature fruit is used as a condiment. When the berries are dried at this season they become of a dusky red; they are ground or beaten to a coarse powder, are exceedingly acid, and a piquant addition to the celebrated *kabob*, or roasts, as prepared by this people. Seedless pomegranates, from Djillalabad; soft-shelled almonds, from Ghorebund; the grapes, watermelons, cantaloupes, Samarcand pear, apples, all from the gardens of Istatif, except the first named, and English walnuts, contribute to the supply of local fruits in autumn. The English walnut is a forest tree; it grows luxuriantly and to a considerable size in Cabul and the mountains near, the wood being used for gunstocks and ornamental purposes. The best grapes are so abundant and cheap that I have had my horse fed upon them instead of grain. The horse thrives admirably when thus treated a few weeks in autumn, this diet serving to obviate the evil of continuous dry feeding between the periods of green forage.

Of the cantaloupe, the species called *Sirdeh*, which has been introduced from Tartary, is identical with our nutmeg. This fruit will not grow in perfection in a tropical temperature, but the muskmelon is common all over India and far south. The first is supposed to be of a cooling nature, whilst the last is called heating in its qualities, and, like its species everywhere, is very little esteemed for food. The *Sirdeh* or nutmeg cantaloupe of Cabul is of the same fine flavor with our own, keeps well, and grows to a much larger size when cultivated under congenial circumstances, as is the case in Cabul and the sandy plains of the Oscus, in Tartary. The introduction of the *Sirdeh* into Cabul, where it grows in the dry, sandy beds of rivers which formerly streamed from the mountain gorges, was attended with difficulty, owing to an insect that attacked the fruit in an early stage of its growth. It was soon discovered that the evil which threatened its annihilation—for the wound inflicted caused the fruit to split open and become knotty—could be avoided by burying it in the sand beyond the reach of its enemy; this process also forced the fruit to ripen sooner, being subsequently exposed to the sun before maturity, when the insect had disappeared for the season. This method of raising the cantaloupe, and the practice of raising the pomegranate as a wall fruit in Tartary, are, I think, the only methods of artificial culture known to the natives, if we except irrigation. This species of cantaloupe, with the Husseinee grape, the almond, the pomegranate, and dried fruits, are exported by caravans in large quantities to the great cities of India, as far south as Lucknow and Scind, and also to other marts, by all the commercial routes radiating from Cabul east, west, and south. Such is the variety of exposure, and consequently of temperature, among the Caucasian glens, that the genial breath of spring mingles in places with the hot airs of midsummer, and all these fruits are contemporaneous in the market. Among the dried fruits of commerce the apricot is conspicuous; being properly stoned, the kernel is taken from the fruit and re-introduced, then the fruit is dried in pressed forms for exportation or winter consumption. The white mulberry and kishmisnee grape are also cured in the sun; the former constitutes a favorite food of the mountaineers, who attribute their characteristic hastiness of temper to this peculiar diet. All the fruits of Cabul are grown in the open air without artificial means. The process of fertilization consists exclusively of irrigation for all purposes of agriculture. The grape-vines remain exposed to all the severity of climate. The vine, for ornamental purposes, is sometimes trained in the form of an arbor, frequently covered with snow without much injury to the fruit, which is often allowed to remain on the vines during part of the winter until wanted for consumption; in this case the fruit will be partially wilted, but not spoiled.

The seasons are clearly defined, and very rarely disturbed by storms or sudden revulsions. Winter commences generally by the falling of snow about the 12th of December. The cold is sometimes severely felt, but the thermometer

(Fahrenheit) seldom marks below the twentieth degree. At this season earthquakes are frequent, but not violent. The ground is frozen very hard, and usually remains covered with snow until the vernal equinox. Early vegetation starts in warm situations about the latter end of February, and is first seen in the budding of the *bede mushk*, or sweet-scented willow. This tree, or rather bush, for it resembles the basket willow, is first to open its blossoms, and is joyously hailed by the expectant natives, wearied by the restraints of the colder months; and as the rains of spring dissolve the snows and cleanse the surface of the earth, the vegetable world seems to bound suddenly forth in all the glow and freshness of a new creation. Every dry stick blossoms like the rod of Aaron; the twittering of swallows and the songs of birds mingle in harmony with the voice of troubadours, the tinkling of guitars, the ringing clash of cymbals, the roll of the drums, and the merry notes of the violin—all welcoming in concert a renovated world. The spring advances rapidly, being seldom interrupted by frosts after the opening of the almond blossoms, although this fruit (produced only in one low-lying valley in the vicinity of the city) is sometimes injured or retarded by a sudden change in temperature. I shall conclude my remarks on the fruits of Cabul by adding a description of the *singid* tree, which I omitted inadvertently, before proceeding to state the inferences and practical conclusions to be drawn from this somewhat diffuse narrative. I shall also allude to the meteorology of Cabul, which in a measure influences the mode of grape culture there, to show wherein the phenomena differs from those of the Ohio valley climate, so that *our* mode of culture shall correspond with the necessities of our own meteorological conditions.

The *singid*, or *sinijid*, is more a subject of novel admiration than utility. Its fruit when dry (and it is not used in its recent state) is of an oval form, about an inch in length and half an inch in its shortest diameter. It very nearly resembles in appearance the date, when that fruit assumes a red color in its unripe condition; the cortex of the *sinjid* fruit is much the same as the recent sun-dried date, and also the stones of these fruits resemble each other. The pulp of the *sinjid* dries to a mealy substance and is slightly sub-acid; it is used only in small quantities, and I am not aware of its possessing any very estimable quality. The tree is ornamental, and I think belongs to the class of willow, of which it resembles the swamp species. It is cultivated chiefly for the fragrance of its blossoms, the odor of which is intense. I find the following remarks in my journal upon this tree: "The roads about Cabul are shaded by the *sinjid* tree and sweet-scented willow, whose fragrance loads the atmosphere with talismanic odors, while clear streams of living waters refresh the vegetation on their banks and fill the air with cooling influences. The fragrance of the *sinjid* blossom is said to render women more susceptible to the impressions of tenderness and love, but to create in men a cold negation of temperament and disinclination to *folatrerie*. The fragrance is more intense than that of any other flower. A gelid, musk-like scent proceeds from it, pervading one's faculties with feelings of serene repose." I have no doubt this tree would be much approved with us for its cool shade, the scent of its flowers, and its ornamental adaptability. It grows to the size of our swamp willow, and would be useful in parks and for other similar purposes.

You will observe that the fruits of Cabul offer a wide field for the consideration of the agricultural branch of your office, not that *similar* fruits are not produced in countries more accessible to your agencies, but they *do not exist in perfection* in any other cold climate corresponding with the climate of the Ohio valley. I am aware that the apricot and the nectarine are raised—the former in the State of New York, and the latter in the vicinity of Boston. They are precariously cultivated there as *espaliers* and wall fruits, with little flavor and in small quantities, frequently falling prematurely and yielding an unremunerating return.

The meteorological phenomena of Cabul differ from the Ohio valley in the rains of spring and the droughts of summer. Indian corn will not come to perfection in Cabul in consequence of the shortness of the season, whilst the grape will not grow to perfection in Peshour—a city on the northern frontier of India—where Indian corn is a celebrated staple. The spring in Cabul opens as with us by continuous rains; they begin and they cease with more regularity than in our climate, but we could readily compensate for this difference by possessing a control of the means of irrigation, to be used or withheld at will. The grape requires a regular and periodical supply of water, and until we resort to this method of culture we cannot secure constant success in the vintage. It may be that in favorable seasons irrigation may prove superfluous; but should you be unprovided with the means of irrigation in case of drought the vintage would be lost. This is a result which rarely occurs to the vintage of Cabul; and I have never heard that their vines are subject to the disease that devastated the vineyards of Europe a few years since. It is to irrigation that we must look for success, the proper management of which means will be necessary to make our country a wine growing region. This will add nothing to the expense of growing the grape. The Ohio and Kentucky slopes are peculiarly adapted for this mode of culture, and the preparation of those slopes for irrigation is simple and inexpensive. The vineyard once started remains a permanent improvement, and the primary arrangement is effected with very trifling additional labor to the ordinary preparations for planting a vineyard in our usual style. A slope, the steeper the better, should be selected for the purpose of a vineyard in the Ohio valley, with a southern exposure, where the rays of the sun may beat with all the intensity which characterizes our climate in the months of June, July, and August. The fruit must rely upon its own foliage for protection; the vines must be pruned to develop a proper condition of foliage; and its nourishment must be accomplished by the appropriate use of irrigation to secure it from the effects of drought.

The climate of France, Italy, or Spain does not demand this precaution; neither does the climate of those countries resemble that of Cabul or the Ohio valley. There can be no difficulty in selecting a site for your vineyard under the flow of water, either naturally or artificially arranged. Our springs are variable in temperature and moisture; it is only the latter phenomenon that can injure the vine by its excess. Should the ground be prepared for irrigation, an excess of rain can be avoided by shutting off the sluice, an act that can be performed by a shovelfull of sod; and, again, the obstruction is no less readily removed. After the cessation of the spring rains the vine must be watered three times a week, as a general rule, subject to the judgment of the cultivator; but two weeks before the fruit matures great care must be taken to shut off from the vine all excess of water. In case this precaution should be neglected there will be great danger of preventing the complete formation of saccharine matter, and in place of a good wine grape you would realize only a very superior table grape. In this case sugar would have to be added to the juice if used for making wine, and the result would be a fiery liquor with considerable body and good keeping qualities, but deficient in the mildness found in natural wines. These instructions are brief and simple, but they comprise all the general principles necessary for the success of grape culture proposed to be introduced in the Ohio valley. The pruning of the vine must be performed about ten days or two weeks before the sap starts; and if the spring should be unusually dry the sap should be *made to start* by letting in the water and allowing it to stand in the trench, in which the vine must be planted, at least for the period of one week, or as long as may be necessary. In watering the vineyard on other occasions the process should be performed at night—commencing about sunset and leaving off three hours before sunrise

In Cabul the vine requires no artificial support, and is never, except for orna-

mental purposes, allowed to grow higher than two and a half or at most three feet. The branches are so trimmed as to present an umbelliferous form, the leaves and the fruit being confined to the space of about one foot at the top. From three to five bunches are allowed to mature upon each vine, which, after a growth of three years, will be of sufficient thickness to stand alone. In some places, as in Bulkh in Tartary, a country not so favorable to the grape as Cabul, the climate being warmer and the plateau at a less elevation above the sea, although it is four degrees north of Cabul, the vine is also planted in a trench, but is made to run over a terrace about six feet broad, and the fruit to rest upon the earth. In that country there is a sweet, black or dark purple Kishmishee grape produced, which makes a good red wine, similar to our imported article called Port wine, but not of the English manufacture we usually receive in this country. There is doubt that this grape of Bulkh would grow with us in the open air. It might, however, be tried in a more southern region than the Ohio valley, probably in the vicinity of Memphis or somewhere in Arkansas. In Bulkh snow does not lie through the day, although the mountain tops remain covered several days in the early spring.

The following remarks on this subject are taken from my journal, written when I resided a few months in that country as commander-in-chief of a division of the Cabul army, in 1838 and 1839, in a campaign against Muraad Bey, prince of Kundooz. This extract is a repetition of what has been said above in this connexion; but my object is to lay before you the authority for these remarks:

"The late autumn rains, which dissipate the burdened atmosphere of summer, in this province of Bulkh, commence about the first of November, and continue with little intermission until the cold of winter changes the phenomenon into snow. During February and March snow frequently falls, but it does not lie permanently, the frost not being sufficiently severe to freeze the ground. It usually melts as it falls, except during the night, but is never seen far from the mountain skirts after meridian. During winter the thermometer will not fall below the freezing point in the plain between the mountain skirt and the river Oxus. In Samarcand, however, where the finest pomegranates are raised as a wall fruit, being a few degrees further north, this small tree, or rather bush, is commonly buried or covered during winter with straw and earth. Towards the south, proceeding in the direction of Cabul, such is the rapid elevation of the great mountain range that every degree of cold prevails from that which is here stated up to the line of perpetual snow. High winds prevail from the first to the fifteenth of January, accompanied by light rains, which make the air raw and chilly. At this season the khirgah is peculiarly appreciable. This khirgah is a conical frame work constructed of light willow and covered with thick felts, forming a warm domicil in ordinary use amongst the migratory class of the population. The wood of the pistacha* growing in the mountains affords an ample supply of fuel. The fire is lighted on the ground in the middle of the tent, and the smoke escapes through a hole at the peak, which, when not in use, may be covered by a small triangular felt, movable by appropriate cords. When the winter breaks up and the weather becomes variable, a sudden cessa-

* This tree presents a conspicuous illustration of the fact that fruit bearing perennials produce alternate crops varying in quality and quantity. The tree yields a crop of fruit one year followed always by a crop of blighted fruit. The latter is like the former in external appearance, but is somewhat larger and quite destitute of a kernel. This blight, however, is of more commercial value than the perfect fruit; it is used to make an infusion that forms a mordant upon woven silk. There is a manufacture of silk in Cabul resembling the English lutestring, a heavy, enduring, and valuable article, the gayer colors of which are remarkably brilliant. The scarlet dye and its varieties are procured from imported cochineal, which is called in the Persian language "kermes," signifying "warm." My impression is that the brilliancy of the coloring is derived from the mordant used.

tion of cold causes the premature expansion, occasionally, of the almond and apricot blossoms, which then suffer by the treacherous indications of approaching spring. The climate, during this period, continues variable until the vernal equinox. After the tenth of April the heat becomes sultry; although there are no continuous hot winds, as in India, the refraction from the sandy soil is oppressive. The horticultural operations of this season commence with pruning the vine on the first of March. Their mode of cultivating the grape is peculiar to this region. Trenches are dug about one foot in depth, the earth being thrown up in the form of a terrace one foot high and six or eight feet broad. The vine being set in these trenches about three feet apart, is allowed to run over the terrace to the next trench, at the edge of which it is cut off, and the lateral branches are allowed to spread, being trimmed in to three or four buds. In this way the vine and the fruit rest upon the ground. The effect of this plan will be to force the fruit by the heat or refraction from the soil. After pruning water is let into the trenches, which are kept filled, and allowed to continue so one week. After this first watering irrigation is performed every two or three days, according to the humidity of the season. The vine should not be watered after the fruit begins to ripen. To water the vine at this period would deteriorate the saccharine principle and destroy the flavor of its fruit. The several kinds of grape produced in the province of Bulkh are all excellent. The sweetest and best wine grape is called *Kishmish;* it is a black, seedless fruit, of an oval shape, about the size of a person's first thumb joint. It differs in flavor, size, and color from the Cabul grape of the same name. It is used by the Jews of the city for making wine. The Mohammedans do not manipulate the grape for this purpose—such use being prohibited by the Koran. A few of the higher classes furtively indulge in the occasional consumption of wine, but the habit is by no means a general practice of the community. The common application of the sweet grapes in all Central Asia is to make Sheera, or ordinary sweetening, for the laboring classes. Fine loaf-sugar is largely imported from Russia, and the crystallized candy is brought from Southern India. A coarser article of this nature, called *goor*, is made by inspissating the juice of a peculiar cane which, like the grape juice, is not crystallizable. This cane grows in Djillalabad and in Scind, and is in all probability identical with the Chinese sorghum in the crystallizable quality of its juice. Upon this latter supposition, however, I am not personally experienced. The pomegranate, the pistacha, and the apricot in all its varieties, are produced in excellent quality in this country. The apricot is most successfully cultivated in the elevated valleys of the mountain region south of Bulkh. There the tree is planted in extensive orchards, and grows in the heavy soil of their glens to a large size, much taller and thicker than our largest pear trees. This and the mulberry are the principal trees found in the vicinity of cities and villages. Raw silk being also a staple, the mulberry is grown more for its leaves than its fruit. For this purpose the branches are kept closely trimmed, and the stock is not allowed to grow more than about six feet high. After a few years this tree must be renewed, when intended for silk-growing on an extensive scale The crop of apricots is incredible to our experience of that fruit in this country. It serves many purposes of domestic utility. When the fruit is to be dried it is first stoned, then an almond kernel is introduced, and the fruit is dried in pressed forms. Oil is expressed from the kernel in sufficient quantities to supply, in a great measure, the demand for culinary purposes and for illumination. But for this last object the oil of mustard-seed is commonly in use. The pulp of the yellow, acid species of apricot is used in their processes of dyeing and as a horse medicine. When quite ripe the pulp is made into large masses, partially dried, and rolled into sheets, which, when further cured by drying in the shade, are rolled up and thus kept for use through the season. There are several varieties of plum; the most useful and agreeable being the *Alvo Bocharah* and the sweet prune plum. The former, when dried, acquires a sharp, acid taste,

which the recent fruit possesses in a slighter degree. A cold infusion of this variety forms a pleasant refrigerent, much used as an antifebrile remedy or ptisan, not unlike the infusion of tamarinds. The soft and hard shelled almonds are plentiful; also several kinds of large, excellent peaches. Melons are abundant and of superior quality. The watermelons are sweet, crisp, and well flavored. The cantaloupe consists of few varieties, all of which are good. The best are produced at Kundooz, near the river Oxus. A melon of this description was brought to me from Kundooz, in the month of February, when I was encamped in the province with the Afghan army, to which period it had been artificially preserved, that weighed about eight pounds. When fresh it must have been somewhat heavier. Although Bulkh is four degrees north of Cabul, its vegetable productions indicate a warmer climate, owing to its lower elevation above the sea level. The climate of Kandhár, south of Cabul one hundred miles, for the same reason is similar to that of Bulkh. Both are favorable to the grape, but the varieties are different from those of Cabul."

It will be seen from these discursive remarks that the grape is grown to perfection throughout a wide expanse, confined, however, to temperate zones. Including Cabul, its habitat prevails in all the varieties of temperature, with a difference in their qualities, which seems to be the result of heat, humidity, and rapid growth appropriately graduated. Within the sphere of its habitat its saccharine quality is more perfectly developed by a high temperature of its peculiar climate, whilst within the tropics it is not produced otherwise than by artificial cultivation. In Kandhar, which is the warmest climate favorable to the grape, there is a species mostly used for making raisins, of so intense a sweetness as to require a dipping into hot water, in the process of curing, to prevent the candying, which would otherwise deteriorate its commercial value. Cabul and its vicinity is the only cold country known where the grape is found in perfection. This is "the garden eastward" alluded to in the Bible. It is the most ancient portion of the globe in a communal sense, and therefore the most experienced in practical results of industrial pursuits.

Whether the climate is natural to the grape, or whether the grape has by perseverance of human application become acclimated to the region, cannot be determined; but the fact is before us that a climate whose vegetable products and meteorological phenomena so nearly resemble the Ohio valley produces in perfection the grape, whilst in all other cold climates this fruit is grown only by means of artificial culture. That the climate of our country is favorable to the *natural* growth of the vine is evident from the thriving witnesses to be seen in all our northern forests; and it would seem that the only desideratum is to procure a fruit of good quality, accustomed to a climate like our own, to take the place of the rank-growing, spontaneous species which are found here in so great an abundance, to succeed in the cultivation of a fruit which is the recorded emblem of wealth, luxury, and prosperity.*

To return to my remarks upon the mode of preparing the ground for a vineyard. Having selected the locality, as already directed, whether a slope or a

* Northeast from the city of Cabul, as ascending the vast Caucasian range which terminates at the river Indus, about five degrees further east whence the Himalaya commences, the district of Kooner is situated. Here the plateau is elevated about eight thousand feet above the level of the sea, and the climate is consequently much colder and the season of summer much shorter than at Cabul. But Kooner is equally celebrated with the former city for its superior grapes. Even in the higher altitudes, which include the country known as Kafiristan, the grape still continues to produce abundantly. The inhabitants of this region are distinguished by a fair skin, light hair, and blue eyes; are quite savage, having no idea of a superior being, and possess manners and customs distinct from the Mohammedan communities surrounding them. There is perpetual war between the Kafirs and Moslemen, who frequently make inroads upon them for the purpose of procuring slaves. The grape-vine of Kafiristan would be an essential acquisition to our country, and may be obtained through the means of such border communication as necessarily exist between these hostile races.

level, the surface must be terraced to admit of the necessary process of irrigation. The terraces may be of a width to admit a single row of vines, as on a steep hillside, or they may consist of broader beds, as upon a level surface, where several rows may be planted about three feet apart each way. The surface should also be so constructed as to admit the water through a small passage, at the highest point capable of being closed or opened by the removal or deposit of a single shovelful of sod. If the locality is a hillside, the edges of the surface must be secured from washing by a strong, well-set sod of grass; upon a level this precaution would not be necessary. In the absence of sod, a few stones would be still more appropriate for the edging. During a protracted rain this access of water to the terraces may require to be shut off. There should also be a vent at the lowest point of each terrace, formed similarly, and attended to when necessary for the purpose of a drain. By closing or opening the last vent of the suite of terraces the water could be kept stationary or allowed to flow off.*

It will have been observed by a perusal of these pages that many fruits exist in Cabul which, if grown in this country, would add greatly to the extent and value of our commerce and the comfort of our people. The acclimation of a perfect wine grape would of itself command the lasting gratitude of future generations, and place high upon the pedestal of fame the name associated with the successful attempt to accomplish this enterprise of national concern. The object of the writer is to show, by a comparison of the vegetable production and a few meteorological phenomena, that the climate of our Ohio valley, already known to be appropriate to the cultivation of the vine, closely resembles, if it be not identical with, the climate of Cabul—a country pre-eminently celebrated for the productions of its vineyards. I am aware that efforts have been made in Ohio to acclimate the European vines, which resulted adversely. This was probably due to incompatibility of climate and the mode of cultivation. It is not conclusive against the possible success of that enterprise in other localities, in a country ranging through every variety of temperature, as is the case with our country. Even should the present efforts of our horticulturists be rewarded by success, it is doubtful whether the European grape embraces the advantages of the superior luscious wine grape of Cabul, which thrives so luxuriantly in a climate of low temperature. The apple and pear, which are natives to Samarcand, the peach of Persia, the buckwheat of Persia, and many other fruits and vegetables of Asia, are grown in our quarter of the globe with conspicuous success, while in Europe those fruits are nowhere produced in perfection, if we except the pear of France; and there again the cherry is not found, which is a native of Tartary, of which Samarcand is a capital city, in Central Asia. Our climate is apparently more congenial to the fruits of Central Asia than is found to be the fact in Europe. We produce in high perfection many of the fruits from Central Asia; there is good reason to infer a similar result will attend the proposed importa-

* Any further information will be cheerfully communicated should your department require additional explanations. Should you have had leisure to peruse the printed "Memoir" I placed before you when in Washington, you will perceive in "Dost Mahomed's" personal history, where allusion is made to my visit to the prince as ambassador from Runjeeth Lingh, in whose service I then was, that great personal danger must be risked by Christians travelling or attempting to travel in Afghanistan. Since the destruction of the British army which essayed the conquest of their country, the jealousy of the natives has been greatly increased, and the difficulties and dangers, at all times serious and almost insurmountable, can only be avoided by the direct authority and protection of the prince, exercised through the chiefs and rulers of the villages and districts under his control. This influence becomes available to a traveller intermediately, who may have the means of friendly intercourse with some influential person of a tribe between whom and himself the rites of hospitality may exist. My long residence in the country and familiar social intercourse with the ruling family are incidents which secure to me uninterrupted friendly relations; and in the event of adventitious difficulties, my familiar knowledge of their language and of their manners and customs would favor the security of a successful disguise.

tion of the grape-vine from Cabul, where the peach, the pear, the apricot, and the cherry, now grow in abundant perfection; all originally introduced there from the plains of Tartary, and those fruits are equally congenial to our own climate. The products of Cabul and its vicinity proper to be introduced into this country I shall name in the rotation of season, namely: the mulberry in three varieties, in view of silk growing; the rhubarb, or pie-plant, known as *Rewash;* the apricot in all its varieties, as heretofore mentioned; the Tartarian cherry for drying and preserving; the peach, the stock of which appears to be deteriorating with us, and requires renewal; some species of cabbage; the sinjid; the sweet-scented willow, and the several kinds of grape-vines, together with those of Bulkh and Kandhar. From this latter place, and also from Djillalabad, the pomegranate and the fig might be tried for cultivation in the southern region of the United States, as Arkansas, Tennessee, and Alabama, or where the orange, or rather the lime, is known to flourish. Attention should also be given to the double-humped Bactrian camel, which, since the dromedary has been now successfully naturalized in Texas and our western desert, should also be brought here to perpetuate the valuable "Booghtee" or hybrid, the offspring of the Bactrian double-humped male camel and the female dromedary.*

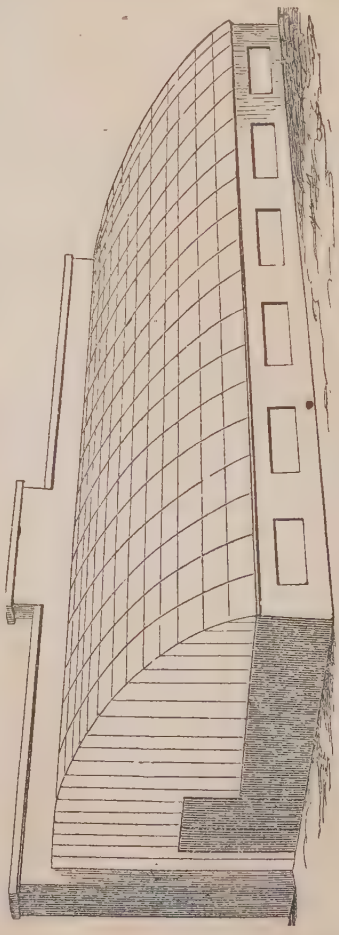
I will conclude this voluminous report on the fruits of Cabul and vicinity by a statement of the probable expense of the enterprise. The ordinary price of a passage to India by sea is one thousand dollars. But as expedition would be requisite for the speedy accomplishment of this proposed enterprise, Bombay should be reached by the overland route, *via* France or England, and Egypt. The passage money and subsistence might exceed the sum stated. The expense of travelling from Bombay to Lahore, the capital of the Punjaub, in Northern India, a distance of twelve or fifteen hundred miles, would, with subsistence, amount to one thousand dollars or more. At Lahore, or at Peshour, five hundred miles further northwest, having crossed the river Indus, the traveller must provide himself with a saddle-horse, two baggage ponies, and with equipments for caravan marching, so that his outfit and the expense of reaching Peshour would be about one thousand dollars. From Peshour to Cabul, *via* Djillalabad, a distance of about four hundred miles, through a constantly ascending mountainous country, the expense of master, servants, and cattle would be within four hundred dollars, making a total of three thousand and four or five hundred dollars. Returning would cost as much more; making in all seven thousand dollars. Some specimens of improved fire-arms would be necessary, as presents for the ruling prince, Dost Mahomed. The cost of these articles, and the charges for procuring, packing, and transporting the desired articles, and the expense of messengers, &c., should be charged as they occur. I should suppose, allowing for the agent's salary and travelling expenses, the expedition might be achieved within an expenditure of ten thousand dollars. An appropriation of thirty thousand dollars was made by government, or rather Congress, and placed under the control of Secretary Davis, which he expended for the purpose of importing camels. Is not the naturalization of a wine grape of vastly more importance than the naturalization of a beast of burden, not absolutely *necessary* for our population? I by no means intend to depreciate the experimental venture of importing the camel. By the comparison I wish to exalt the other enterprise. Untold treasures would be as chaff if weighed against the moral, commercial, and national benefits to be derived from the acclimation of a wine grape in these United States! Much may be said also upon the advantages to be derived by means of commercial treaties with the princes of Central Asia and the Shah of Persia, which could be accomplished by this same agency without the necessity of government being at the expense of a minister plenipotentiary for the purpose. In these days of war expenses, and necessity for economy, this fact should have weight with the officials and with Congress.

* See Report of the Commissioner of Patents for the year 1853, Agriculture, p. 61.

ORCHARD HOUSES.

BY DR. GEORGE PEPPER NORRIS, OF WILMINGTON, DELAWARE.

By an orchard house is meant a house where fruit trees are grown under glass. At first this may strike the superficial observer as being a most unnecessary appendage to a garden, but when it is recollected that our finest smooth-stoned fruits, as the plum and nectarine, are almost unknown, owing to the depredations of the sly curculio, and that often our entire crops of peaches are destroyed by the early spring frosts, it will be seen that orchard houses are not only useful but necessary to those who wish to make sure of a crop of matured fruit.

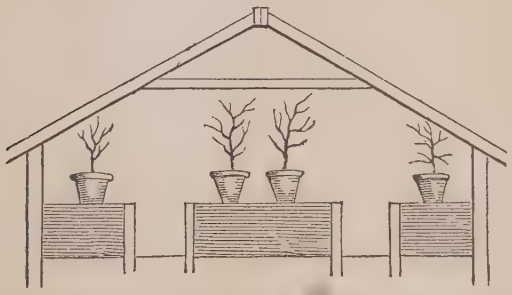


ORIGINAL DESIGN FOR A CURVILINEAR ORCHARD HOUSE.

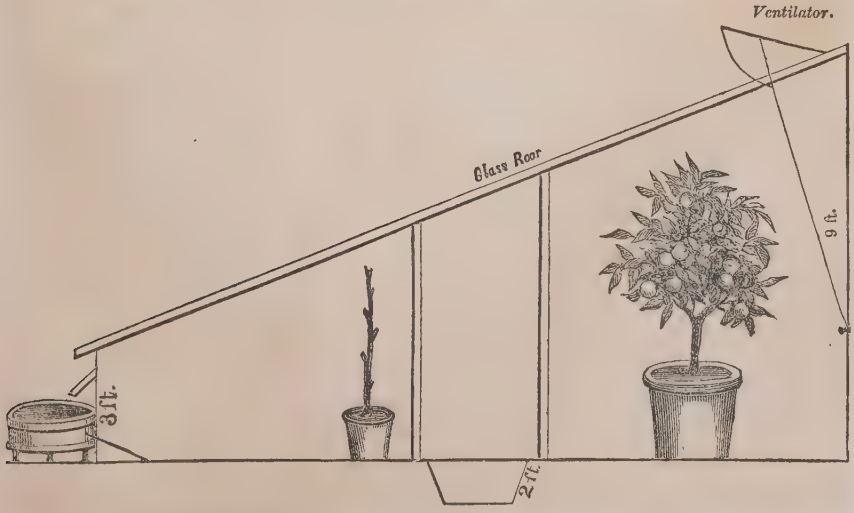
To Mr. Rivers, of England, the public are indebted for bringing to notice this method of growing fruit; a pamphlet of his, giving the necessary directions for building and fruiting the trees, has had a success in England unprecedented in horticultural annals. To use his own words in the preface to the fifth edition: "Orchard houses are now familiar things; hundreds are rising up all over the face of the country; no garden structures have ever advanced so rapidly in popularity." So must it be in America, for our English friends have not the curculio to contend with. Already quite a number have been erected in various parts of the New England and middle States, prominent among which are those of William Beach Laurence, esq., at Newport, Rhode Island; that of Mr. Hubbard, in Massachusetts; that of Mr. Joseph S. Lovering, near Philadelphia, and the more unpretending affair of the writer, at Wilmington, Delaware. As far as tried, they may be, with certainty, pronounced a success.

The form of the orchard house may be the span-roofed or the lean-to, and the length may vary from ten feet to a hundred. A lean-to orchard house fifty feet by thirteen may be thus simply constructed: select cedar posts ten feet long, and plant in the ground five feet apart; they should be about two feet below the surface. To this back row of posts nail one-inch tongued and grooved flooring boards. We have thus the back wall. For the front, posts five feet long, sunk in the ground two feet at a corresponding distance with those in the back, will be needed. Flooring boards, nailed on as in the back, will make the front wall three feet above the surface of the soil. The back wall will be eight feet above the surface soil. On the front and back row of posts the wall plates for the rafters to rest on must be firmly braced. The main rafters should be of

PLAN OF ORCHARD HOUSE, the trees growing in prepared border. Suggested by William Saunders, esq., Germantown, Pennsylvania.

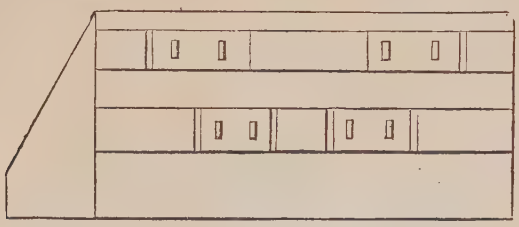


PLAN OF ORCHARD HOUSE, the trees growing in prepared border. Suggested by William Saunders, esq., Germantown, Pennsylvania.



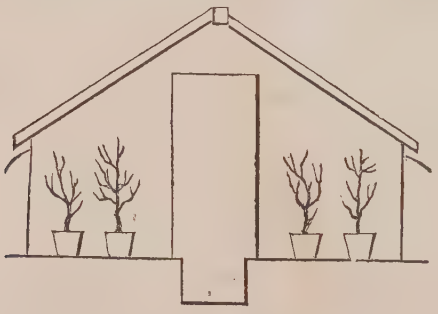
ORCHARD HOUSE OF DR. NORRIS, WILMINGTON, DELAWARE.

yellow pine; eight will be required for a house of these dimensions. Between the rafters sash bars, on which the glass is to be bedded in, should be placed; ten by twelve fourth quality glass will be found a convenient size, and the glass should be placed on a layer of putty and fastened with sprigs, the panes overlapping about the eighth of an inch; the ends to be made similar to the back. Thus a cheap frame house, with a tight glass roof, is made. Ventilators are to be had in the front and back wall by having boards on hinges, to be opened and shut as required. A door in each end completes the house. The path is formed by excavating the soil two feet in the centre of the house, between the doors.



Back View of Lean-to Orchard House, showing Ventilators.

This gives a front and back border, in which the trees may be grown, or on which the pots with the trees may be placed. If preferred, the back border may be subdivided by raising the half adjoining the back wall nine inches, forming a step or tier. The trees may be grown directly in the earth of the border, in which case the border should be prepared as I have recommended in an article on grape culture, to be found in this volume. The trees so grown should be trained on espaliers, and annually root-pruned. The usual, and I believe the best, method is to grow the tree in a pot or tub and stand it on the border. Peach, nectarine, or plum trees, intended for orchard house culture, may

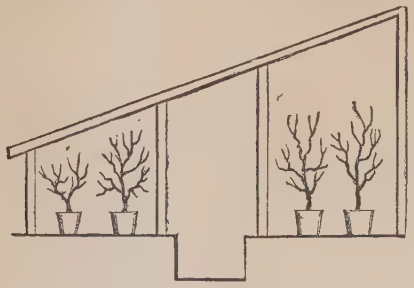


Span-roofed Orchard House.

be potted at any time, weather permitting, between November and May. They should be severely pruned, and potted in a compost of old soil, leaf mould, wood ashes, and sand.

The size of the pots will vary with the tastes of the cultivator. Eleven-inch pots are the average, although fine fruit may be produced in nine-inch pots. Sometimes for larger trees fourteen-inch pots are preferred. For the first season the potted trees should be plunged out of doors and freely watered. In the autumn, if they have had fair treatment, they will have almost entirely filled the pots with roots. Their winter treatment will consist in again shortening in, top dressing, and depositing in the cellar until February, taking care not to allow the roots to get too dry.

On the approach of spring they are to be removed to the orchard house, well soaked with manure water and suffered to start. No pot tree should be allowed to mature more than fine fruit the first season. Vigorous pinching will be required during the summer, and after the fruit has become as large as walnuts liberal application of well-diluted manure water should be made. During summer the ventilators, over which thin wire netting should be placed to exclude insects, should be kept open night and day. Nectarines and peaches do better in pots than apricots or plums. Figs are among the earliest to fruit. Trees already



End Sketch of Lean-to Orchard House. (From Rivers.)

grown in pots are to be had, and where a few for experiment are only grown, a season will be saved by obtaining these. It is recommended by some to enlarge the hole in the bottom of the pit, and permit the roots to enter the border, and in the autumn to remove the external roots. Of nectarines, for pot culture with the writer, Violet Hative Stanwick, Boston, and Early Newington have succeeded best; of peaches, the Early York, Crawford's Early, Morris White, and Grosse Mignonne are recommended; of figs, Brown Turkey and Black Ischia; of plums, Jefferson, imperial gage and purple gage; of apricots, the Early Red, Breda, and Moorpark.

FRUIT CULTURE.

BY J. K. ESHELMAN, DOWINGTON, PENNSYLVANIA.

The renter of a few square feet of ground can grow his strawberries, currants, gooseberries, and even grapes, the next season after planting, so that if he remain in possession only two years, he may enjoy those healthful products. But, without further "essay," a few plain practical directions *how* it is to be done will be more appropriate.

The same preparations of soil should usually be made, whether we plant a small or large space. That this preparation be thorough is of the first importance. How much soever the after culture and treatment may differ in the different varieties, the first operations of trenching, enriching, and draining may be the same.

The earliest fruit produced in abundance is the—

STRAWBERRY.

To grow this in great perfection, a soil composed in part of clay seems desirable. If the ground be sufficiently fertile to grow corn or potatoes, trench it

two feet deep, allowing a portion of clay, two to three inches, to remain on the surface, pulverize with your rake, and set your plants in rows, two feet apart, and from ten to eighteen inches apart in the rows, according to the vigor of the variety. This may be done as soon as the young plants of the same season's growth are sufficiently rooted to admit of removal—from the last of August to the first of November in this latitude, or early the following spring. If only a few plants—the first produced—are grown from a stool, they will be of the best quality; and if carefully removed in September they will yield a crop the following season. These should be protected by a covering of straw, leaves, or long manure, during the first winter. Some recommend covering every winter.

The points of culture are, to keep the ground loose and free from weeds, and the plants free from runners. When runners are required for new plantations, they can only be grown at the expense of fruit, and should always be produced in a separate apartment. When large space is occupied, the culture will of course be easiest accomplished by horse-power with suitable harrows. In garden culture, nothing is superior to a good cast-steel rake.

The length of time that the plants will remain productive and profitable seems yet undecided; reputable authority asserts five to ten years. Here it has proved less trouble to make a new plantation every third year than keep in check the grasses and weeds. Even if kept free from these, the plants seem less productive after the third good crop. It is best, therefore, to plant every season, have three plantations or beds, and, as the oldest become unproductive, dig or plough them down. The space necessary to supply a family need not be large. We have averaged one quart to (2.16 square feet) two and sixteen-hundredths square feet, or at the rate of 630 bushels per acre.

RASPBERRIES IMMEDIATELY SUCCEED STRAWBERRIES.

The production of the hardiest varieties of this fruit is very easy. Any good soil will produce a moderate crop, even without trenching; but in large plantations, or where grown extensively for market, a thorough preparation, by trench-ploughing or spading, will insure better crops and more permanent productiveness. The stools should be in rows at least four feet apart, and two feet in the rows. At the time of transplanting, all the old stalks should be cut off—one strong shoot from the first year, to bear fruit the next, which at the approach of cold weather is laid down and covered with earth, especially the more improved and tender varieties. Soon after the crop of fruit is gathered, the stalks which bore it should be cut off close to the ground, and two or more, according to vigor and variety, of the strongest and best situated, encouraged to produce bearing wood for the following season. Proper stakes or trellises to support the fruit-bearing stalks will suggest themselves to every grower. By covering the space between the rows with decomposed manure in autumn, and incorporating it with the earth, will insure continued fertility for six or seven years.

BLACKBERRIES.

These are grown in the same manner. Their greater vigor and larger growth require more room. The rows should be six feet, and the plants at least four feet apart in the rows. Not more than two young shoots should be allowed to grow; and these stopped when four to six feet high, but allowed to branch freely. The bearing wood is cut off soon after the fruit is gathered, or any time before the following spring.

CURRANTS AND GOOSEBERRIES.

These are easily grown at the sides of garden walks, on the edge of garden terraces, or in special plantations. The fruit is grown on spurs, on wood not

less than two years old, and consequently some discriminating knowledge in pruning and training is required. The bushes should be kept open, a portion of new wood grown each year should be shortened in the following spring. Plants are easily grown from cuttings. Wood of the previous year's growth, taken from the plants in February, and inserted two-thirds of its length in the ground as soon as the frost is out, will soon make good plants, which, while young and vigorous, always produce the best fruit. Renewal of plants every four or five years is judicious; though with care and proper management they will produce good crops of fruit much longer.

GRAPES.

The culture and management of this favorite variety of fruit have received so much deserved attention from the ablest men, in reports of the Patent Office, that it would be a work of supererogation to attempt additions.—(See Patent Office Reports, 1856, p. 408; 1857, pp. 227–237; 1859, pp. 71–78; 1860, pp. 359–416, as well as papers in previous pages of this volume.)

PEACHES, CHERRIES, PLUMS, APRICOTS, NECTARINES.

In most localities success is less certain with these. Diseases called "yellow," and cracking of the bark, destroy the trees of the first and second—the curculio, the fruit of the rest. The remedies proposed for the difficulties are numerous and varied, but pratically very inefficient. The theories of one who signally fails in practice would be worth very little; therefore we will pass on to

APPLES AND PEARS.

To produce these in great abundance and perfection should engage the serious attention of the community. The ease and facility of their transportation, their increased consumption, and consequent high price, should give an impetus to production in every locality adapted to their culture.

With due care in trenching, trench-ploughing, the application of proper fertilizers—decomposed stable manure, lime, ashes, potash, salt, &c., &c.—and in selection of varieties and planting, they can still be abundantly produced in most localities. To be more specific, let me urge upon every person who contemplates the growth of these fruits for his own family, or for market, to spare no pains in commencing aright. Let the ground be thoroughly broken with a double Michigan and sub-soil plough, or trench-plowed by passing a good Barshear plough ten inches deep and following with another of different construction, a Willy, and throw up another furrow six inches deep from the bottom. If not previously underdrained it can be done after the trees have grown a year or two. The distance asunder to plant must depend upon the variety. Dig your holes at least three feet in diameter for small trees, throw the richest earth on one side and the poorest on the other. Have your trees carefully taken up with special reference to their roots, as trees are now abundantly grown in almost every portion of the country; this is easily done, and if grown in your neighborhood they can be taken up and replanted the same day, without the usual tumbling and drying processes to which they are frequently subjected; plant them as nearly as possible at the same depth as they grew. Remove all mutilated roots. Spread those remaining in their natural position, covering the lowest first with rich earth, and continue until all are covered; then tramp the earth with your feet to press it in contact with every root; or the same can be accomplished by throwing in water; then fill in the remainder of the earth, forming a slight elevation or hillock around the trunk to keep it in position. All this is best done in autumn, as soon as the leaves have fallen. Pears may usually be transplanted earlier than apples. In proportion to the diminution of roots by trans-

planting should the branches be removed or shortened. It is best not to cut off branches close to the trunk, but to allow an inch or more to remain to be removed subsequently, when the tree has regained its vigor and is prepared to repair the injury. The subsequent annual and summer pruning of both pears and apples—for the same treatment applies, in a great measure, to both—requires knowledge and judgment in keeping a properly balanced and symmetrical head. This knowledge will be acquired by experience.

More than three branches, equally distant, should never be left in an annual tier. Some recommend only two on opposite sides, and the next year two more at right angles with these. It is difficult, if not impossible without diagrams, to explain the manner of pruning, and for details works expressly on the subject, reports of the different pomological societies, State and national, may be consulted:

Before concluding this brief and imperfect sketch, a few remarks will be added on selecting varieties. So numerous are the lists now recommended that the beginner is confused rather than enlightened.

Let it be emphatically understood that a whole orchard, however large, if planted with only *one*, or at most with three varieties, *known to succeed in that particular locality*, will prove more satisfactory and profitable than by substituting far-fetched, dear bought novelties, no doubt "very good" elsewhere.

Plant largely that variety which you *know* to be productive, hardy, and "good," in your soil and neighborhood. Even if many succeed, a very few of the best will suffice.

If your market be easily accessible summer and autumn varieties will prove most profitable, because, being more perishable, they are rarely supplied from a distance.

The spaces between standard trees, apples and pears, should be kept well cultivated. Root crops (no other should be attempted) may, for a few years, be produced by annual manuring. When trees have grown to bearing size the ploughing, always shallow, and the production of other crops than grass should cease. Cultivation of the ground must still be continued, unless, as just remarked, it be sown with grass. Practically we have not yet determined the better way. If sown with grass, annual top-dressing will still be necessary.

A FEW WORDS ON HORSES.

BY RUTH HALL.

ORIGIN OF THE WILD HORSE IN NORTH AMERICA.

Good authority (D. C. Linsley, of Vermont) says, "In none of the breeds of wild horses, whether we consider those of the plains and pampas or of the Tartarian deserts, nor in the ponies of the Indians or the nobler animals of the southwestern territories of the United States, do we find or recognize an original race," and in the latter especially we see traits and strains of blood proving them descendants in a remote and distant period of time of escaped captives from the rule of man.

Frank Forrester says on this subject: "It is somewhat doubtful to me whether the horses found in a feral state in Texas and the Mexican provinces are not the descendants of chargers escaped from the romantic expedition of

De Soto through those very regions, rather than of those liberated at the abandonment of Buenos Ayres, or of other escaped or emancipated animals of Spanish breed from the southward of the isthmus."

Since the intricate, forest-cumbered, and brake-entangled nature of that dark and dangerous bridge between the two portions of the continent, as well as the adjacent regions both to the north and south of it, fit them so ill to the horse, an animal attached to wide, open plains and prairies, and singularly averse to woody morasses and densely-clothed wildernesses, I cannot readily believe they would voluntarily have involved themselves in those labyrinths of cane-brakes and mazes of almost impenetrable vegetation, in progress of unmeaning migration toward unknown future habitations.

We may believe, then, that the wild horse of America is of Spanish origin. He certainly is to this day marked by many of the characteristics of that race, which shows by the fineness of its limbs and the peculiar formation of its head the large admixture it possesses of Moorish and Barbary blood. It has always been the fashion to ascribe the excellence of the Spanish and especially of the Andalusian breed to the Arabic invasion of 710; but, although the great benefit derived from that strain and from the wise encouragement given by the refined and polished Moors to this branch of national power and greatness must be allowed, I look much further back for the source of the blood whence the Spanish horse derived his earliest excellence, and ascribe it to the judgment of the great Carthaginian family of Barca, which ruled over the Mediterranean as conquerors and sovereigns, at the head of powerful native African armies, mounted on the desert barbs of the Moors and Arabs. It is impossible to believe that such a state of things existed among a warlike and equestrian people without their seeking to improve their own horses by the admixture of the foreign blood, the superiority of which they could not fail to perceive in the shock of battle, even apart from the casual intercourse which must have occurred between the indigenous mares and the strange troop horses.

This, doubtless, was the first cross of oriental blood upon the Spanish stock. Of the actual Spanish horse of the days of the conquest of South America, when the animal was in his greatest purity and perfection, comes the wild race of the South American pampas and of the southern and southwestern prairies of the United States; and from this, to a certain degree, it is probable that the domesticated stock of some of the southern States has received a remote cross of the Andalusian blood. In Louisiana that cross was obtained and still exists in a more direct form, although it does not appear that their peculiarities continue to be distinguishable to any considerable extent in the external characteristics of the animal.

But as it is a recognized fact that, with a strain of good blood to begin with, by the aid of skilful and scientific crossing and culture horses may almost be raised to order, it is well to accept instruction from any who may have proved themselves masters of their art. Let us, therefore, give heed to the example of the Arabs, who still stand at the head of stock-raisers, even in the nineteenth century. With them we find that more stress is laid on the quality of the dam than the sire; that a first-class mare cannot be bought from an Arab, since he knows from tradition what watchful experience is now teaching us—that there is scarcely a disease which is not inherited more frequently from the dam than the sire. Hence the fastidious care shown in the selection of brood mares, and the care bestowed on them and their offspring.

The barbarian has learned—let us hope his example may sometime benefit his Christian brethren—that gentle treatment and intelligent usage of the colt is all the breaking required; that not to fear man is one of the most important lessons his intelligent companion can acquire; and that, by so identifying their interests, he can obtain willingly all that *we* rend from him by the aid of whip

and spur; that is to say, the utmost rate of speed of which he is capable, and willingness to continue his pace until death, if need be.

I hope in time not only to see horses intelligently and justly dealt with, but that every farmer as well as professional horse-raiser, and those who cultivate the animal for sporting purposes and for profit merely, will give more attention to the stock they propose to propagate, caring more that the mare shall be free from blemish, whether hereditary or acquired, and shall be young, vigorous, not broken down with hard labor, of roomy form and good blood, than that the sire should be some fashionable creature with a long pedigree. On the road, on the farm, or as draught horses, use, if you please, mares in the splinter or any other infirmity, for they are tougher than a horse, less liable to injury, and will do more work on less feed. But for breeding purposes select and keep the *very best*. I am astonished that "great expectations" should be entertained of the colt of Prioress, a mare that labors under the disadvantage of being so far broken down that her progeny in all probability will be merely a sinking fund for sporting men.

If it were necessary to multiply authority, hear what "Cecil" says on the same subject in regard to the horses of Australia. At first horses were imported exclusively from England, but they were found to rapidly degenerate. The wastes of Chili and Peru were then tried for mares, and this step was followed by the production of a breed admirably suited to the country. Sure-footedness and endurance are now eminently the characteristics of the Australian horses, and their sagacity probably exceeds that of all other breeds.

It is wonderful to see the Australian stockman at full speed after a drove of wild cattle, amid a mass of forest of which neither he nor his horse have the slightest knowledge. The ground beneath his feet is full of yawning chasms in the earth, caused by the dryness of the climate, whilst the overhanging branches threaten him every moment with such blows on the head as, if not avoided, would speedily put an end to his horsemanship. Under these circumstances there seems to be a compact between horse and rider that the one shall look at all dangers beneath the feet whilst the other ducks between the overhanging branches, and together they perform feats which few steeple-chasers would face. And with them accidents are very rare.

A similar and, perhaps, a still better animal is being rapidly introduced into New Zealand. The breeding stock is the same, but, from the greater favorableness of the climate, it is probable that that country will produce one of the finest classes of horses in the world.

The South American horses imported here are fresh from the prairie, where they have been caught with the lasso, and the operation of breaking them does not take place until after they have landed. Several Chilian or Peruvian horse-breakers always accompany the cargo for the purpose.

We have often witnessed the process of these persons in backing the wild horse, as he finds a purchaser, from the ship. As it is curious, and may afford hints to others of the craft, we will describe it: A post is firmly fixed in the ground, to which a ring is attached. The horse is then brought to the post with a long halter, and made fast. The breaker takes his poncho—a large cloak worn by the South Americans—and ties it round the eyes of the horse, so as to blindfold him. The animal is then left to himself, and shortly begins to tremble with fear at his unwonted, helpless condition. A profuse perspiration breaks out upon him, and, if suffered to continue thus, he falls from the exhaustion of the nervous system caused by his fright. Before this takes place, a rude saddle is placed on his back, heavily weighted at the stirrups, and to this he quietly submits. Presently, when the animal is stupified, the breaker goes up to him, and, patting his neck and otherwise caressing him, in some respects soothes him. This goes on till the horse exhibits signs of reliance on the man. By and by the poncho is removed, and the lesson wished to be im

parted has been learned, namely, that of looking upon the one who has relieved him from the fearful poncho as his friend.

We have seen this lesson so skilfully administered that the breaker has removed the weighted stirrups, and immediately mounted on the bare back of the horse, which behaved with perfect docility.

More generally, however, the lesson, always the same, has to be repeated till the horse becomes perfectly docile, having learned to rely on man. And, if afterwards kindly treated, there are no more docile horses to be found in the world than these wild horses fresh from the pampas.

This is pointed testimony to the efficacy of kindness in the subjugation of so impressible an animal as the horse. Consider the difference between the kind of coercion used by the enlightened American in breaking a colt—the torture to which the animal is called on to submit by that diabolical instrument, the bitting bridle, hurting the sensitive delicacy of the skin, in many instances inaugurating the life-long suffering of a tender mouth; then the checking, drawing the head into an unnatural position most painful to the muscles, and, while the horse is irritated and fretted with pain, the ignorant endeavors of a still more ignorant and brutal man to teach a horse to submit to the saddle or harness, to learn his paces—and all this is to be taught by suffering only, the whip the sole persuader! Contrast this with the education afforded by the uncivilized Chilian. Allowing common sense a word, even in such an affair as training a colt, throwing preconceived prejudices aside, which is most likely to be successful in obtaining intelligent obedience? If I could see the bitting bridle thrown aside, the check rein, especially for draught horses, abolished, and the absurd practice of docking done away with, which virtually proclaims that man better than the Creator knows how to make a perfect and beautiful animal, I should be more willing to acknowledge the progress of the nineteenth century. This latter barbarity, now considered by the best judges of horses to be both injurious and disfiguring, as weakening the spine and often inducing permanent injury through the carelessness or ignorance of the operator, is of much less frequent occurrence than formerly. For that slight amelioration, and the hope arising from it, let us be thankful.

THE DOMESTICATED HORSE OF THE PRAIRIES.

The wild animals of these regions strongly resemble the same animal in the rocky region of California, and are of diminutive size, tough, hardy, rather thick-limbed, rugged-coated, with bright, intelligent eyes. Vicious, nay, wicked as they seem on first acquaintance, they are yet easily subdued, and, like their hotter-blooded brethren of the Mexican plains, when caught and haltered will fly round and round in a circle, greatly dreading the touch of one they naturally consider their enemy, the captor, and yet never straining or tautening the lasso after the first or second effort to break it has failed. Thus, if, directly after their capture, they are fastened alongside a horse in harness, they will rarely fail to keep up with him, never straining back or showing signs of stubbornness, though others are as remarkable as mules for their dogged obstinacy. It is a well-ascertained fact that a cross of these hardy creatures with those of better blood results generally in animals remarkable for speed and endurance.

It is singular that, while climate has undoubtedly so much effect on animals as well as man, the Indian ponies of the mild and equable region of Illinois and Indiana are as small as the same race in Canada, where the severities of the weather as well as sparseness of vegetation would naturally be expected to dwarf those exposed to its inequalities. Yet so it is, and in hardiness, intelligence, and endurance there appears but little difference. The aborigines, like the Arabs, dislike parting with their horses, so that often when they have been induced to trade by some article irresistible to their fancy, as soon as sober

reason has regained her sway, they have been known to return from great distances to recover their four-legged treasures. This, however, is more applicable to the Indians of the Rocky mountains and vicinity. Along some of the rich bottoms of Illinois, and by the side of the rivers, from neglect and inbreeding the ponies have dwindled almost to the size of Shelties, without any of the redeeming qualities of that pigmy race. Still, the better specimens of them, crossed with a good breed, produce sometimes valuable and useful horses, as in the instance of Ruskum and Stranger, supposed to be the offspring of English cavalry horses, escaped during the war, and native Canadian ponies. In fine, the prime charcteristics of the wild horses of the prairies are hardihood and endurance, and it is our business to see how these qualities hold out in their improved state.

Of the cultivated animals of prairie-land, to which nearly every part of the world has contributed its share, in the region which was not long ago one of the best horse markets in the States, it will be hard to find distinguishing traits; yet no one who ever saw an assemblage of the horses of Chicago, famous for its love of sport and good teams, but would remark the general beauty of the animals exhibited, whether in drays, buggies, or in the evening drive, showing their paces on the avenue. Of medium size, with a preponderance of good colors, (which I consider blood bays, and often reminded by a golden bronze coat, fine as silk, of old Eclipse and his progeny,) the exhibition would win for the people the credit, which is well merited, of being good judges of horses and ambitious of securing first-class specimens for themselves. During the State fair held some year or so ago, the horses of Illinois and the neighboring States compared very favorably with those of professed stock-raisers who reckon back confidently to imported sires.

The early settlers on the prairies, allured by reports of the teeming soil, unencumbered by trees and free from brush or stones, which the hardy New Englander or the patient farmer from Maine and New Hampshire had fought and struggled with through life, wandered from these last inhospitable regions to find peace and plenty in the then almost unknown west, and as there was no other means of conveyance than the prairie schooner, as the large tilted wagons were called in which they carried their "plunder," even if they employed oxen to draw the vehicle, as was often the case, yet, when able to afford it, they took also their best horses with them for future use.

As use meant hard work, their heaviest beasts, those which could throw most weight into their collar in drawing great loads, were generally selected. These, when transported to the luxuriant plains, where they stood knee-deep in rich and abundant pasturage, feeding without stint on the clean hay, entirely free from dust, so different from the cough-engendering, powdered, and innutritive feed they had been accustomed to, grew larger, heavier, and healthier, and with more abundant spirits fulfilled their daily tasks; while the owners, no longer bound down by the drudgery necessary to obtain a scanty living, and feeling themselves well to do in the world, wanted a better team, or their sons did after them, and as demand creates supply, long strings of horses were regularly filled out, both from the south and New England, for the western markets, where even if horse jockies expected to find dupes they were much mistaken, and the best animals were selected at high figures, while the pelters had to go further to find a market. Thus almost every breed or strain may find a representative; and so intermingled are the various traits that the most daring asserter of race would be puzzled to assign their supposed parentage, although nearly every one, and more especially the Morgan, improves on the western prairies. Not only is the upland grass particularly nourishing from its density, being nearly solid through, and entirely devoid of the hollow which makes many grasses mere shells, engendering wind, but the medicinal qualities of many plants growing wild is undoubted, and instinct teaches each animal to select the one necessary for its

relief. I can only instance the species of grass known as the rosin weed, which, it is proved, is almost a certain cure for the heaves and all such affections, and which the horses afflicted with diseases of that class select from all others, and devour with avidity. Under such circumstances, it is not to be wondered at that the first remark of strangers generally is, What handsome horses there are in the west—what indications of blood in their fine heads and slender limbs, how glossy and silky their skins, and how well-fed they look. And it is so. Grain is cheap, and hay may be had for the cutting, so there is little excuse for animals not being in good order. As people became richer the sports of the turf grew into favor, and where could such level tracts be found as in the prairie States? So, with a population as reckless in their expenditure as those of New Orleans, and (before 1857) speculation being rife, fortunes (in corner lots) were made in no time, where could be found a dashing people more willing to pay for being amused, and so by a natural spirit of emulation, better stock was sought from which to produce trotters worthy to compete even with Flora Temple. Thus, Reindeer, raised in the southern part of Illinois, and the handsomest specimen of a horse for style, action, and symmetry ever seen in any region, became the pride and boast of Chicago.

Jack Rossiter was a native Illinoisian, and his exploits may be found in the racing calendar. Lady Jane was famed justly for speed and bearing, as well as George Wert, and a host of others. But while it began to be noticed that nearly every breed improved on the prairie grass, some, even old horses, growing every way, and many, considered incurables, becoming perfectly sound, still the Morgan horses especially seemed to profit by the genial climate, improving in all their best points, and losing many not so desirable, though the opposition (there always is an opposition) declare the feet of this breed become defective on the sandy roads of the prairie. I never could induce one to define his position, and declare exactly *how* the feet failed, or any theory of the cause.

"Beautiful as is the horse," says Youatt, "and identified so much with our pleasure and our profit, he has been the object of almost universal regard; and there are few persons who do not pretend to be somewhat competent judges of his form, qualities, and worth." Few have the honesty of Dickers, who confessed he neither liked nor understood the animal; and among many pretensions there are few more general than an affectation of connoisseurship in horses. From the nobleman, with his numerous and valuable stud, to the meanest helper in the stable, and not excluding even the mechanic, who rarely crosses or sits behind a horse once in a twelvemonth, there is scarcely a man who would not be offended if he were thought altogether ignorant of horse flesh. There is no subject on which he is so positive; there is no subject on which he is, generally speaking, so deficient; and there are few horses, on some points of which these pretended and self-sufficient judges would not give a totally opposite opinion.

The truth is that this supposed knowledge is rarely founded on principle, nor is it the result of the slightest acquaintance with the actual structure of this animal, or that form and connexion of parts on which strength or fleetness or stoutness must necessarily depend. If we were constructing or examining a machine composed of levers and pulleys, and by which we proposed to raise a great weight, or to set in motion certain bodies with a given velocity, we should fail in our object, or expose our ignorance of the matter, if we were not aware what kind of lever or connexion of levers was necessary, in what situation the ropes should be placed, and in what direction the force should be applied, as well as by what means we could obtain mechanical advantage, and by what peculiar construction it would inevitably be lost; yet many who would be posed to describe the distinctive traits of any peculiar race, talk learnedly of the degrees of comparison between them, and every horse fancier has a pet breed, of whose merits he is as tenacious, and on whose superiority he is as touchy, as on the ability of his chosen clergyman or physician.

I may now confess to the same weakness, and though I admire the beauty and fire of the Messenger, the grand carriage of the so-called descendants of Eclipse, I must confess that, as a roadster, as a general horse of all work, the Morgan has my suffrage, at all events for the level prairie, with its often heavy sandy roads.

He is thus ably described by Linsley:

"If size is, as is claimed by some, the measure of power, it will be found that form is the measure of action. Too much size is, indeed, incompatible with rapid and long-continued movements.

"The most casual observer of a good Morgan horse is conscious that he sees a peculiar animal. His short, light, rapid step point to the great muscles which give him motion. His prominent, clear, eager eyes, set wide apart, (a very favorite feature of mine, and indicating great intelligence, and mild and gentle temper,) testify to his courage and docility; while his clean, light head, carried high, with short pointed sensitive ears, gives grace and elegance to every motion."

Mr. Linsley's general description of the Morgan will show what reason I have for my preference. That breed has a small, lean head, broad between the eyes, which are prominent, bold, lively, and pleasant, full of spirit and courage, yet mild, giving evidence at once of a temper spirited and tractable. The ears are small and well-shaped, set rather wide apart, but are delicate and lively.

The back is short and broad, the hips well coupled, the loins wide, and displaying on either side masses of firm, unyielding muscle, which will satisfy the horseman of his ability to carry weight and endure fatigue.

Just behind the withers the back is often a little depressed, and individuals are occasionally met with in which the depression is sufficient to warrant their being called hollow or sway-backed; this must by no means be considered a characteristic, many families being entirely free from it, and where it is found it is usually very slight.

The average height of Morgan horses may be stated at from fourteen to fifteen hands high. They are particularly remarkable for their great strength in proportion to their size, and for their power of endurance, bearing up under hard labor that would break down the strongest draught horse.

Though small, they are noted for great bottom and hardihood, as well as for compactness and roundness of form. He is a very sprightly animal, and said to be more sagacious than the generality of horses.

The testimony of Milo June, as one who well understands his subject, on the value of the Morgan horse, is worth recording. He says: "I have spent the greatest portion of my life in staging, formerly in Vermont, and now in Missouri, and I take pleasure in bearing testimony to the decided superiority of Morgan horses for coach service over any others that I have ever used. I have bought many horses in Ohio, Kentucky, Indiana, and Illinois, and though occasionally a good roadster may be found they are not common. Many of the horses of these States have fine forms and good carriage, yet lack the high free spirit, unflinching courage, and iron constitutions the Vermont horses so generally possess. Very many of the western horses are too large. Immense horses may be best for draught, but I have always found those of medium size, weighing, say about ten hundred and fifty pounds, much the most serviceable and enduring when used before a coach."

M. O. Walker corroborates his statement thus:

"Being a Vermonter, I have known Morgan horses as long as I have known any. I have resided at Chicago the last seventeen years, during which time I have been largely engaged in the business of staging, which business affords constant employment for about fifteen hundred horses, and thus have had opportunities for observing and testing the capacity and endurance of different kinds. I have no hesitation in saying I consider the Morgan horses far superior

to any other breed or blood I have ever known for the road or farm. In fact, I would prefer them over all others for any kind of service on the American continent. They are invariably good feeders, are easily kept, and will not only perform and endure more service in a year, but more years of service than any other breed of horses I have ever known. Of the horses heretofore raised in the western States, and particularly west of the lakes, (although much improvement has been made within a few years, and many fine specimens may now be found among them,) it is undeniably true that a Morgan horse from New England will outlast two horses raised in the west. It is also true that but few Morgan horses have as yet (this was some years ago) been brought from New England west of the lakes, and equally true that their services are very generally sought by intelligent breeders of horses throughout the country. Any number of inferior horses may be found which are claimed to be of Morgan blood. This attempt to palm off counterfeits is the highest evidence of the value of the genuine breed. The ready and general objection in the west with those not familiar with the strain is want of size, forgetting that it should be judged by weight and not by the length of their legs."

Now, their size, as a corrective of the tendency to overgrowth, common to prairie horses, which is objectionable in a roadster or buggy horse, is, in my eyes, one of the Morgan's beauties, and the reason I believe a large infusion of their blood to be particularly useful where the breed, if not closely watched, is in danger of becoming weedy. After having said so much in their favor, it is but fair to state that neither Youatt nor Mr. Herbert (Frank Forrester) agree with me in my admiration.

The agricultural fairs in the prairie States excite a great amount of laudable emulation, and elicit a fine show of very creditable horses of home raising to compare with those of the earlier settled countries, where they have had more time and means; for it requires several generations of horses to acclimate and bring to perfection breeds from different climates and localities; but the fairs of Michigan, and especially of Illinois, are becoming notorious as places where good steppers and capable judges may be found. Not only is this the case, but several rich, liberal, and enterprising men have been at great pains to bring into the vicinity animals carefully and scientifically selected, as most likely to benefit the race, considered in conjunction with the spot where they were to be placed and the stock on which they were to be engrafted. Particular attention to this point, as all will allow, is one of the niceties of horse raising. By crossing the breed we understand the selection of a sire composed of wholly different blood from that of the dam, or as different as can be obtained of the same strain, for inbreeding beyond two stages deteriorates the constitutional health, diminishes the bone, and lowers the height, which last may be one of the reasons why the native Canadian and Indian ponies dwindle to such puny size. The great difficulty in the way of breeders is to obtain a cross without destroying the symmetry of the proportions.

The following points of a thorough-bred are laid down by Stonehenge, and are a good criterion to judge from, remembering that an ounce of blood is worth a pound of bone, and that it has been ascertained by actual weight that the shin-bone of a full-blooded animal, though so slender in appearance, is as heavy as the same limb in the heaviest cart horse. This is to be accounted for by the superior density and hardness of the bone, the hollow being very large in one instance and very small in the other, thus giving much more power and force to the latter than the former.

The head and neck should be characterized by lightness, which is essential for this department, especially if speed be an object, for whatever is unnecessary is so much dead weight, and we know the effect of even seven pounds in impeding the horse over any distance of ground. Now, seven pounds are easily bestowed upon a neck which may differ in at least twenty or thirty pounds

between the two extremes of lightness and excessive weight. Thus, it may be considered as indubitable that whatever is met with in the head and neck which is not necessary for the peculiar purposes of speed is so much weight thrown away, and yet it must be carried by the horse.

Such is the general character of this part, but, in detail, the head should be lean about the jaw, yet with a full development of forehead, which ought to be convex and wide, so as to contain within the skull a good volume of brain. Supposing this fulness to exist, all the rest of the head may be slender as possible, the jaws being reduced to a slight nozzle, with a shallow hollowing out in front, but with a width between the two sides of the lower jaw where it joins the neck, so as to allow plenty of room for the top of the windpipe when the neck is bent. The ears should be pricked and fine, but not too short; eyes full and spirited; nostrils large, and capable of being well dilated when at full speed, which is easily tested by the gallop, after which they ought to stand out firmly, and so as to show the internal lining fully. The neck should be muscular, and yet light; the windpipe loose, and separate from the neck, that is, not too tightly bound down by the fascia or membrane of the neck. The crest should be thin and wiry, not thick and loaded, as is often seen in coarse stallions or even in some mares. Between the two extremes of the ewe neck and its opposite there are many degrees, but for racing purposes I should prefer of the two the former to the latter, for few horses can go well with their necks bent so as to draw the chin to the bosom; but here, as in most other cases, the happy medium is to be desired, which is that exhibited, says an able horseman, in the figure of Kingston, a horse as remarkable for his shape as for his exceedingly distinguished performances. His head and general form are those which may be selected as the pattern for the race-horse, for though he is often considered too light in the girth, he is, in my opinion, just what a race-horse should be in that department, which is more frequently too deep than the reverse, and his well-known stoutness verifies the opinion.

The body or middle piece should be moderately long, and not too much confined between the last rib and the hip bone. So long as the last or back ribs are deep, it is not of so much importance that they should be closely connected to the hip bone, for such a shape shortens the stride, and though it enables the horse to carry great weight yet it prevents him from attaining a high rate of speed.

The back itself should be muscular, and the hips so wide as to allow of a good development of the muscular department. The withers may rise gently, but not too high, with that thin, razor-like elevation which many people call a good shoulder. The chest itself should be well developed, but not too wide and deep. In the formation of the hips the essential point is length and breadth of bone for muscular attachment, and it matters little whether the croup droops a little or is pretty straight and level, so that there is a good length from the hip to the haunch bone, the line between which should be a long line, and the longer it is the more muscular substance is attached to it and the greater leverage will the muscles have.

The fore-quarter should be well set on to the chest, and the shoulder blade be obliquely on the side of that part, with a full development of muscle to move it and thrust it well forward in the gallop.

The shoulder should be very muscular, without being overdone or loaded, and so formed as to play freely in the action of the horse. The point of the shoulder should be free from raggedness, but not too flat; the upper arm, between the joint and the elbow, long and well-clothed with muscles; the elbow set on quite straight; the lower arm muscular and long; knees broad and strong, with the bony projections behind well developed; legs flat, showing a suspensory ligament large and free; pasterns long enough, without being weak; the feet sound, neither too large nor too small.

The hind-quarter is the chief agent in propulsion, and therefore of the utmost consequence in attaining speed. For the full action of the hind-quarters two things are necessary; first, length and volume of muscle, and, secondly, length of leverage upon which the muscle may act. Hence, all the bones comprising the hind-quarters should be long, but the comparative length should vary a good deal. Thus, the hips should be long and wide, and the two upper divisions of the limb, viz., the stifle and lower thigh, should be long, strong, and fully developed; the outline of the outer part of the thigh should be full; the bones below the hock flat and free from adhesions; the ligament and tendons fully developed; the joints well formed and wide; pasterns long and oblique; and, lastly, the feet correspond to those already alluded to in the anterior extremity.

The color of the thorough-bred horse is now generally bay, brown, or chestnut in ninety-nine cases out of a hundred, while in the descendants of Eclipse it is often of a beautiful golden bronze.

While on the subject of blood, I may be permitted to remark that "Observer," one of the authorities quoted by Frank Forrester, says, "The purer the blood the more likely it is to be transmitted, and whichever parent boasts the purest strain will be most generally represented in the offspring."

The prairie States, where level, beautiful stretches of ground form natural tracks free from bog or stump, seem to court the formation of trotting matches, and we find, indeed, this to be one of the most popular pastimes; and on the course of Kalamazoo Flora Temple achieved her most brilliant victory. It has been proved, after much contradiction, that it is a full mile in circuit, and it is a fact of world-wide notoriety that the queen of the trotting turf circled it in the almost fabulous time of 2.19. It was no small stake which could induce the owner of this priceless mare to exhibit her prowess, and proves that prairie farmers think little of money when horse flesh is concerned, and from this we draw the conclusion that in the future few States will be able to compete with them. No one who has once seen the little bay mare and her style of going will ever be at a loss for a minute to characterize it by some word probably coined in their own brain from the novel sensations experienced on looking at her low, level, equable gait, which does not impress as very swift, so void of strain, so easy is every motion, until compared with the one going by her side. Her exceeding speed has been very scientifically accounted for by her build and perfect concentration of means of locomotion, though few but sporting men would pause to reflect on the cause of her swiftness as she fled around the circle without other apparent means of coercion than her own ambition, her tiny hoofs ringing measured music on the track, and neither break nor skip marring the harmony, as her nervous ears evinced her quick and sympathetic intelligence. By her side, on the occasion of her appearance at Chicago, went Princess, once called Topsy, whom it was my good fortune to have seen under happier auspices soon after making her début. No ill-temper then prevented her from doing her best, and though she paced a step or cantered a length or so, (she had just begun her trotting career,) she lost not once or gained in the opinion of the judges, and caught step with wonderful rapidity. Her future, which I foretold, and was laughed at for my prophecy, was soon after as brilliant as could be desired. Her form was handsome, her style of going lively, her action spirited, and, had it not been for some as yet not well accounted for reason, the bay beauty would have found in her a dangerous rival. Nevertheless, when she appeared again on the Chicago track to compete with Flora, she reared and bit as they took off her blankets, and a man starting up from the grass almost in front of her on the back of the track caused her to break and balk in such a style that her driver declared, from his knowledge of her temper, nothing further could be done with her, and Flora waited beyond the half-mile pole, so as not to distance her in the first heat, and disappoint the thousands of spectators who had crowded to see her trot.

On the Garden City track, also, Lady Palmer as well as Topsy made her first impression as a trotter. Her birthplace is matter of dispute. She was called an Indiana horse when owned by Daniel Palmer, and few suspected at one time the rate of speed of which she proved herself capable afterwards, and when she attained celebrity it was claimed she came from Kentucky. However that may be, a more docile, gentle animal never trotted before a sulky, and a speedier need not be, as Robert Bonner, now a connoisseur in horses, soon ascertained, and became her purchaser. She left behind her a beautiful bay colt, named Johnny, who promises fair to equal his renowned dam.

From the earliest days of the metropolis of prairie land the inhabitants boasted of a track, rudely enclosed, indeed, but dry and level, the property of William Myrick, a devoted lover of the horse, and here friendly contests took place between those who prided themselves on their horse flesh, close to the banks of the beautiful Lake Michigan. Of course the grand stand was very primitive; still, the rules of the jockey club were strongly insisted on, and while Indians still bivouacked in the neighborhood, when waiting their annual payments, and herds of deer have been driven into the track and there captured, still the inhabitants had their spring and fall meeting, in imitation of Long Island. Where such devotion to an idea prevails, perfection is often the result, and so we find the prairie horses exemplified in Reindeer, Jack Rossiter, Lady Jane, and others, sufficient to make my treatise merely a catalogue.

In roadsters, also, Chicago stands pre-eminent, her merchants and business men rarely condescending to a horse not capable of doing a mile in three minutes easily, and the road to Cottage Grove, before the railroad was laid down, was the scene of many friendly contests, and no inconsiderable amount of bragging, while the ice on the river, which divides the city, became, during the winter, the chief place of resort.

Frank Forrester says, speaking of fairs in the western States:

"Aside from the regular exhibition and trial of horses at the agricultural fairs, it is becoming quite customary, either for the society or an independent one, to get up an exclusive horse show some time in the spring or fall, where liberal premiums are awarded, and decided on the most part on the ground of speed.

"The general introduction of carriages had nearly done away with saddles, except in the most sparsely settled parts of the country, and with drovers; so that in towns it was difficult ever to obtain a saddle horse at a livery stable, until an original idea was developed by the exhibition of ladies riding at the agricultural fairs, which has grown so rapidly into public favor as to become an institution of itself, and the most attractive feature of the whole exhibition.

"The result of this practice has been that gentlemen cavaliers, being ashamed to be outdone in boldness and skill by the ladies, have taken to the saddle, as escorts of the fair riders; and a taste for horsemanship once created, and the facilities of equipment at hand, there is a great and growing demand for saddle horses, both in town and country, and many of the best nags of this class are in the hands of girls, who have trained them to an admirable style of performance. The docility and obedience of the highest spirited horses in the hands of a resolute woman is truly wonderful. There is scarce a courser in the country that will not yield to a petticoat. Even old Grey Eagle, that had not felt the saddle for years, and was pronounced by his owner impracticable, bore a woman proudly on his back at the State fair in Cleveland, in 1856. And the fiery Hassan yields kindly to the reins of his mistress as he bears her over the field like the wind, with his wide, thin nostrils, flashing eyes, and tail like a great banner in the breeze.

"The contagion of this stirring example of female chivalry in Ohio has extended itself in all directions. Westward, to Iowa and Wisconsin, the ladies' riding has become the feature of the agricultural fairs; southward, to Kentucky, where modish belles first received the idea with prudent horror, the new passion

has become fully inaugurated; and eastward, in New York, and even in old Puritan Massachusetts and Connecticut, in this year of grace 1856, have the long skirts of the lady equestrians fluttered in the eyes of the sons and daughters of the Pilgrims, while they, not knowing what else better to do, have looked on with amazed delight, and finally clapped their hands in honor of the new heresy.

"In Illinois and Indiana the mania took root almost spontaneously, and the fairs now are always largely attended by lady equestrians, who give grace and beauty to the scene, as well as encourage a branch of horse raising too much neglected—animals expressly suitable for riding, which healthful exercise is only too much neglected of late years."

I hope the attention of some of the liberal and wealthy breeders of Illinois and Iowa, who are sparing neither pains nor expense to make the horses worthy of the country they inhabit, will not overlook this particular feature in their anxiety for trotters, which seems likely to become the one idea. Mr. John Wentworth, ex-mayor of Chicago, who has a grand farm in its vicinity, is becoming celebrated for his praiseworthy efforts in this direction, though cattle and hogs are rather more his specialty. Walter S. Gurnee, also, has a stallion, Duroc Messenger, Cash Eclipse, from whom he has raised in the neighborhood of a hundred colts, who are likely to improve even on their illustrious sire, in size and energy; and it is conceded that a cross between this sire and a Kentucky blood mare produces almost the perfection of the equine species. It is somewhat noticeable that, while a southern strain is always thought to improve our race-horses, Tennessee and neighboring States depend on the north and northwest for animals where weight, strength, and power of draught are expected.

Mr. Yates, of Chicago, has a very fine horse, Captain Beauford, which is likely to prove an acquisition to horse fanciers. And last, but by no means least, Milton Patrick, esquire, has a valuable stallion, whose pedigree is beyond suspicion. Sired by imported Glencoe; first dam, Wagner, a celebrated four-mile horse of Kentucky; second dam, by Sumpter, full brother to Rattler, Childers, and Flintilla; third dam, Grecian Princess, by Cook's Whip; fourth dam, by General Hampton's Paragon; fifth dam, by imported Figure; sixth dam, Slammerkin, by imported Wildair; seventh dam, the imported Cub mare. Consequently, there is good reason to suppose prairie land will improve year by year in her horse crop.

And now, in corroboration of the belief as to the merits of Morgan stock for the prairie States, I will quote the opinion of Dr. Sprague, writing to the Ohio State Agricultural Society, of which he was at one time secretary: "I may write you for publication when matters of interest transpire. I will now mention a significant fact, which you can use if you see fit. In moving our horse stock west in February last, we found that such of our colts as were in part of 'Black Hawk' or Morgan origin stood the trip by cars or road 100 per cent. better than those of other blood, were less injured and reduced by distemper, and recovered from this much sooner than the others, eating better during illness, and losing less of substance. Now that they are here, they do best in the native hay, and can trot and run without pain, maintaining their wind when other colts fag and vainly attempt to keep up in the race. Their thick coats and round barrels, accompanied by strong appetites and stronger digestion, make them valuable for this prairie country, where the winds blow sharp, and feeding stations are, in some cases, far apart."

HORSES OF THE SOUTH.

Southern horses are usually considered pre-eminent in point of speed, and when an animal from other parts develops into something more than common an attempt is usually made to trace back their parentage to some renowned dam or sire in one or other of these States, it having been proved conclusively that

southern stock was at some period enriched with Spanish blood, which had at some remote space been warmed from veins glowing from the east; and these regions having always been inhabited by a race unaccustomed to labor, and yet fond of field-sports and out-of-door excitement, mostly blessed with means of indulging their tastes, are very good reasons why horses whose speed was their most valued quality should there be cultivated and encouraged, while animals for purposes of draught or labor, whose drivers were negroes, only should remain scrubs.

I cannot avoid making a suggestion here on the authority of Frank Forrester, who says, of the Irish hunter:

"He goes, owing to the nature of his country, wherein there is little, comparatively speaking, of good galloping ground, the soil being, for the most part, either deep and soft, or broken, rugged, and stony, far more upon his haunches and far less extended than an English hunter. For wall leaping, where there are no ditches, he is unrivalled, though very uneasy and difficult to sit, taking nothing in his fly, but stopping with his forefeet almost in contact with the obstacle, and then bucking over it with all his legs together, and alighting, not unusually, on his hind feet, a practice which, however unpleasant to sit and difficult to unaccustomed riders, unquestionably spares the back sinews of the forelegs many a severe jar.

"He is particularly adapted to the broken, rudely tilled, and rugged country in which he is used; where stone walls are the most ordinary fences, and next to them double ditches, with a turf bank or dyke between them. These latter he has a particularly clever trick of spurning with his hind hoofs as he tops them so as to gain a purchase whence to make a second spring, thereby clearing the second drain, the whole fence being usually too wide to be cleared at a stride, while the turf dike is too rotten and insecure to admit of its being leaped on and off like the somewhat similar banks of Hertfordshire and Essex. For American hunting, where hunting on horseback exists, he is, of all others, the very horse required; his immense power as a jumper of height enabling him to hop over the stiffest six-bar Virginia rail-fences as if they were nothing; while the woodland and otherwise encumbered country would render his want of speed of comparatively small amount. Now, as it is a notorious fact that the south possesses more gentlemen equestrians than any other portion of the States, and hunting is one of their favorite amusements, why may not this hint be acted on, and Irish hunters figure in American forest scenes!"

What a valuable addition might not the peculiarities of this animal become when united by crossing with the valuable surefootedness of the American horse, described by the same author!

"Another point on which the American horse differs extremely, and here most advantageously, from the European animal, is his greater surefootedness and freedom from the dangerous and detestable vice of stumbling. It is only necessary, in order to convince one's self that this is a real and not imaginary difference in favor of our horses, to examine the knees of the hack-horses let for hire, either in the cities or the rural villages of the United States, as compared with those of similar English localities. In this country a broken knee is one of the rarest blemishes, if not the very rarest, one ever encounters in the horse

"Of horses let for hire in England, unless it be by a few crack livery-keepers in London, in the universities, and in one or two other of the most important towns in hunting neighborhoods, the majority are decidedly broken-kneed. Nor is it at all unusual to meet perilous stumblers even from gentlemen's stables, and this in the case of animals whose appearance would indicate anything but liability to so manifest and disqualifying a fault.

"I ascribe the immunity of the horse on this side of the Atlantic from this fault, first, to the fact that both the pasture lands and the roads are far rougher, more broken in surface, and more interrupted by stumps, stones, and other

obstacles here than in the longer cultivated and more finished countries of Europe, which teaches young horses to bend their knees and throw their legs more freely whilst playing with their dams in the field, and also lift and set down their feet with far greater circumspection, even on our great thoroughfares, many of which are scarcely superior to a French cross road, and few of which are equal to an English one, especially in the autumn or in the spring, when the frost is coming out of the ground. To this admirable quality of the American horse must be added his extreme good temper and docility, in which he unquestionably excels any horse in the world."

And, he adds, in conclusion: "I consider the general horse of America superior, not in blood or in beauty, but decidedly in hardihood to do and to endure, in powers of travel, in speed, in docility, and in good temper to any other race of general horses in the world."

This I believe to be less applicable, perhaps, to southern horses than to those of cooler blood, and, indeed, heat and pampered condition, excessive grooming, &c., always induce a degree of vice and restiveness.

The horses of the States under consideration are lighter and finer of limb, longer in form, more graceful in action, more capable of speed, and more impatient of labor than their hardy brethren of the north, and are used more as a luxury than a necessity; and, indeed, Virginia and Maryland, as the headquarters of the cavaliers—the former State having for a long time refused submission to the commonwealth and to stout old Oliver—as the seat of the aristocracy, fashion, and wealth of the colony prior to the revolution, took an early and decided lead in the pursuit of horse-racing; and while the love of the sport continues to distinguish their descendants, who are by far the most equestrian in their habits of any other citizens of the republic, the result of the liberality of the first settlers is yet visible in the blood of their noble steeds. It is probable that racing may have commenced simultaneously or nearly so in the two States above named. It is nearly certain that "Spark," owned by Governor Ogle, of the colony of Maryland, presented to him by Lord Baltimore, who received him as a gift from the Prince of Wales, father to King George III, came hither previous to that event, and was among the first horses of distinction brought to America.

Edgar states, also, that Wilkes's old Hautboy mare, dam by Brimmer, was also imported into Virginia by Colonel Colville, and afterwards known as Miss Colville; also, about the year 1745 there were imported into Virginia Routh's "Crab," by old Crab, dam by Counsellor, daughter of Coneyskins. He was twenty-two years old when imported, but left good stock. In 1764 we find Fearnought, (by Regulus; dam, Silvertail,) whose pedigree may be traced back to the highest and purest blood in England. He left his mark largely on the blood horse of Virginia. It is said that, before his time, there was little beyond quarter-racing in Virginia; that his progeny were of uncommon figure, and first introduced the size and bottom of the English race-horse into America.

But to return to our theme. The southern States, therefore, in which, as I have observed, racing first took a firm root among the agricultural gentry, who, in whatever climate or country, are always more addicted to manly and exhilarating exercises, to field sports, and to the encouragement of objects not merely utilitarian, than the dwellers in cities, who are apt to regard money as the only true and legitimate pursuit, we find that in the south alone were racing stables established either prior or immediately subsequent to the revolution, and not a few are kept up to the present day with vigor and success.

Of the blood horse in Tennessee, and with the ordinary scrub, made up of every breed, we have little to do. Will. Williams, quoted by Herbert, thus writes:

"The first settlers brought here [Tennessee] some of their best stock from Virginia and the Carolinas, and Maclin had, as I am informed, some Mexican

mares of the Barb or Spanish breed; the early stallions here of the Janus family, said to be a son; Cross's Comet; Lewis's, son of Harry Hill's Janus, and reported to have a Marc Anthony and Jolly Roger cross; Sterne, Blakemore's; and Bowie's horse, name pronounced Biney. His colts are declared to have been unequalled as quarter horses."

Of the trotters I say nothing. Of the rackers I may remark that Thomas E. Turnner, of Warren, North Carolina, about 1790 imported from Narragansett bay a light chestnut, called "Free and Easy." As was his name so was his pace. Pedigrees in the south prior to the issuing of the Turf Register depended on manuscripts or memory, and thence followed transpositions and sometimes errors.

SOMETHING OF THE PHILOSOPHY AND CHEMISTRY OF MANURES.

A SEED consists of a *germ*, or *vital part*, or *plant in embryo*, and certain nitrogenous organic compounds, (as albumen, legumin, fibrine,) with other non-nitrogenous bodies, (as starch, fat, and sugar,) all of which are surrounded by an integument, (bran) of greater or less thickness, dependent on the nature of the seed. It also contains a number of inorganic substances, as phosphorus, sulphur, chlorine, lime, magnesia, potash, soda, and silica. This complicated group of organic and inorganic substances is arranged around, and in immediate contact with, the remarkable group of atoms in which the vital principle is located. In a dry atmosphere, at ordinary temperatures, this complicated arrangement of the components of the seed remains undisturbed. In some seeds they remain so for centuries. The starch, sugar, fat, nitrogenous products, and the germ all remain dormant.

But when the seed is planted under proper conditions, it absorbs moisture, swells, bursts its integuments, and the elements about the germ begin to arrange themselves under the influence of the forces that produce growth. About this time a peculiar white, amorphous, indifferent body, soluble in water, appears around the germ. This was called diastase by Payen, in allusion to its power to break up and disintegrate starch grains. Under the influence of diastase the starch of the grain is converted into a gum-like substance called dextrine, and finally into sugar.

The nitrogenous products are also so changed that the whole can be readily appropriated by the germ, which feeds upon them till it has shot out roots into the soil and leaves into the air, about which time the entire seed, excepting its outer integument, will have been absorbed, and its carbon, hydrogen, nitrogen, oxygen, sulphur, phosphorus, &c., used in forming the cells of the little plant just developed from the embryo. Up to this point a wise Providence has supplied it nutriment, independent of rules developed by science for the art of manuring; but here its tiny leaves and delicate roots appeal to science, through art, for further nutriment, which must now be supplied it from external sources in the soil and air. From these two sources it must get all the elements required to form cellulose, woody fibre, starch, sugar, albumen, and all other parts of a perfectly developed plant.

A chemical analysis of a fully developed plant will inform us what these elements are; a few simple experiments with the growing plant will inform us in a general way in what condition they can enter the plant to be assimilated by it; and chemical analysis will inform us how far these elements in an assimilable

condition exist in the soil and air accessible to the plant, as also what substances contain them in case we must supply them to the soil, either to impart fertility to it or to maintain its fertility while the plant is extracting elements from it.

Thus, analysis detects certain elements in plants, the latter get them from the soil, and they must be supplied to the soil in manures, and manures, in general, are combinations of elements previously derived from the soil. The principle involved in the cycle thus simply defined embraces the fundamental basis of the art and science of manuring crops.

We might, for illustration, consider the soil as the bank of deposit, the crops taken from it the successive drafts made upon it, and the manure added the several deposits upon which its solvency is dependent. Or, to speak more philosophically, we might consider the crops as the effect of which the manure in the soil, in common with the other conditions of vegetable growth, was the cause, and effects being dependent upon their causes, the science of manuring teaches us how to modify the effect (a crop) by modifying and controlling the causes, (the amount of manure in the soil and the other conditions of growth.)

So very simple did these general principles appear to those by whom they were first perceived, that they predicted a speedy development of the art of agriculture under a science that embraced them. A soil analysis would give the agricultural resources of the soil, an ash analysis would make known the demands of crops upon soils, and a manure analysis would show how much manure must be added to produce a certain amount of grain. "With this knowledge the farmer would be able to keep an exact record of the produce of his fields in harvest, like the account-book of a well-regulated manufactory, and then, by a simple calculation, he can determine precisely the substances he must supply to each field, according to the crops he has reaped, and the quantity of these in order to restore their original fertility. He would be able to express in pounds' weight how much of this or that element he must give to the soil in order to augment its fertility for any given kind of plant."—(Familiar Letter on Chemistry, Liebig, p. 512.)

A soil containing double as much of the element of nutrition as another soil would have twice the productive powers. A crop taking twice as much nutriment from the soil as another crop would exhaust it twice as much as the latter. An element of nutrition already in the soil in large quantities need not be supplied to it, and the influence of a certain amount of any element supplied in manure must be such part of the whole influence due to that element as the amount supplied was of the total amount of it in the soil after it was added. If analysis showed that the influence of the element added was greater than this, it proved that the effect produced was not due to the nutritious action of the element added. Thus, if the addition of 60 pounds of nitrogen to a soil that already contained tons of it doubled the produce, it proved that the increase was not due to nitrogen, since, if one ton produced 15 bushels, one ton and 60 pounds could not produce 30 bushels, &c.

There is a semblance of plausibility and sound reasoning about these ideas which is better calculated to interest the reader and impress him with the wonderful knowledge of scientific men than to give him any correct views of agricultural science.

They are all based upon the assumption that there exists a very simple relation between the crop and the causes producing it, and these causes are estimated by means which, instead of showing the *intensity* of their action to produce the crops, only show that they are *some functions* of the crop; that they stand in such relation to the crop that as *they vary* the *crop varies;* as they increase within certain limits the crop generally increases, and the converse. But what these limits are; what law of change the intensity of their action follows as they approach the limits, and what is the influence of a large number of physical conditions upon which the growth of the crop is dependent, are all unknown to us,

and hence we are not prepared to enunciate truths expressing the relation between crops and the causes producing them.

Practical agriculture, aided by scientific research, has shown that the agricultural effect, *a crop*, is the result of the operation of a very complicated series of causes. Many of these causes are unknown to us; of the operation of others we have only the most indefinite ideas; while some that we do understand more clearly are beyond our means of control; hence the final resultant of the united action of all of the causes together cannot be estimated from a knowledge of those that we do understand.

Nothing is more common for the farmer to assume than that the succession or simultaneousness of events implies the relation of cause and effect between them. He observes certain phenomena during the growth of a certain crop, and he associates those phenomena with the crop in the relation of cause to effect. Or, he may have performed certain operations in agriculture during the same period, and to these he attributes the property of causation.

Formerly the phenomena of the heavens, and particularly the age of the moon, were taken as *indices* of cause in the production of crops, and at the present day the ideas of many farmers are as indefinite upon the subject of the causes producing crops as were their fathers, who thought more about the lunar sign in which they planted their potatoes than the soil in which they were to grow.

One difficulty of estimating the causes that produce crops is, that one cause is so dependent upon another. Sometimes the operation of one producing cause may diminish the effect of another. A given productive force will be very much modified by the circumstances in which it must produce; these circumstances may vary without our knowledge or control, or they may vary with our knowledge, but without our control.

It would be easy to show that the ordinary language used by many agricultural writers, implying that crops must be proportional to certain things they do or add to the soil, is inapplicable to the case, and that great care must be taken in estimating the value of any one manure, or any one operation in agriculture, since the effect of either can only be observed in the final resultant derived from it in connexion with all the other operating causes.

SPECIAL CAUSES OPERATING TO PRODUCE CROPS.

We have already seen that the growth of the plant is divided into two periods:

1. *The embryonic period*, during which the germ develops into the young plant, which is capable of getting nutrition from the air and soil.

2. The period between the close of embryon growth and the full maturation of the seed.

During the first period the plant derives all its solid food from the seed that contained the germ from which it sprang. The plant is, therefore, of less importance at this period for our present consideration than afterwards, when it must get all its nutriment from external sources. Yet it is not here wholly independent of consideration in regard to plant-food of manures. The grain must have water and oxygen and a certain temperature, or its nutriment cannot be made available for the embryonic plant.

The whole crop is much more dependent upon the influence operating upon the seed than is generally supposed. Every farmer knows that if his seed lies long in the ground when it is cold, wet, or heavy, or extraordinarily dry and parched, his crop suffers as the result.

A heavy coat of caustic lime or ashes, or of any concentrated soluble manure, may damage the seed so that it will not sprout, or will sprout and produce a delicate, sickly plant. A coating of tar or other substance may shut out oxygen from a seed soaked in water so that the grain will rot instead of sprouting. Or

a portion of it may rot or pass into such condition as will not be capable of affording normal nutriment to the plant during its embryonic growth. At this latter period it feeds, not upon the ordinary products of decaying vegetable matter, but upon products that are prepared for it, from fresh vegetable matter, much more rapidly than the ordinary process of decay can supply them. An embryonic plant can consume all the nutrient matter in a grain of wheat, corn, or oats in a few days; as many months would not suffice to convert the same amount of grain into carbonic acid, water, and ammonia for the plant. A number of experiments by Boussingault, (*Chemie Agricole,*) and Lawes, Gilbert, and Pugh, (Transactions of the Royal Society, London,) have shown, conclusively, on the one hand, that young plants can appropriate all the plant food of the grain from which they sprang in a very few days, but that they cannot appropriate it all when supplied in other grains in the state of decomposition; a part, in decomposing, goes into a state not readily assimilable, like that of much of the organic matter and nitrogen of soils, and a part escapes as free nitrogen into the air.

Now, if a part of the grain should pass into this state of decomposition in which its elementary nutrition could not be readily assimilated by the embryonic plant, it must, at that time, exert a very great influence upon the health and vigor of the latter. To this cause we are doubtless to attribute much of the differences which plants from similar seeds present during their embryonic growth, as also the fact that some seeds are much more fully exhausted by feeding the embryonic plant than others. There can, also, be but little doubt that the difference between the food prepared for the young plant from the grain by the diastase, is so different from that furnished by the rotting grain as to produce a diseased state in the plant. Again: the seed may be planted too deep in the ground; all the nutriment it contains may be exhausted in reaching the surface, leaving none for the development of roots and leaves, wherewith to get nutriment from other sources; and when at its surface it enters upon the second period of its growth, the roots of the first period are so deep in the ground that they cannot be used; others must be formed, and the first allowed to decay. The plant cannot tiller at its proper place, and its entire growth is thus retarded and abnormal.

On the other hand, it may be planted at too short a distance below the surface, so that it cannot get sufficient moisture to sprout, and yet enough to disorganize its structure and destroy its vitality, or impair the nutriment which it contains.

Every farmer knows by the bad success that almost always attends very late sown crops how very much depends upon getting the crop in at the proper season, even though, when in the ground, all the conditions of healthy growth possible at a late season are furnished it. But the several causes we have adverted to not only tend to retard the early growth, and thus render it equivalent to a late seeding, but they also deprive it of much of its normal nutriment, and supply it with unwholesome food instead, and, in some cases, prevent the embryonic organs of growth from being used in the early stages of its second period.

Causes, apparently very slight, may often produce the most marked result. The smaller the seed the more likely, in general, it is to be influenced by almost imperceptible causes. In sowing turnips, English farmers not unfrequently remark that in dry, warm days a vast difference is made in the crops by planting the seed in the *fresh moist soil,* just after the marking-out plough, and in planting in the same soil after it has had two or three hours to dry. The very intelligent farmer of the Duke of Bedford, in England, informed the author, a few years ago, that he had noticed a diminution equal to one-fourth the crop produced by letting a row thus dry, before planting, while the men were eating their dinners.

An interesting series of experiments on sprouting grains has recently been made by Frederick Haberlant, (Allgemeine Land und Forstwirthschaftliche Zeitung, S., 610, 1860,) in which he shows that such variations may be made in temperature alone as will cause a difference in the time of sprouting of wheat, rye, maize, and other agricultural plants, of three or four times the minimum time required to sprout them.

It should further be remarked here that certain agents, as chlorine, lime, water, and other substances applied to grains will hasten their sprouting; (see Yahresbericht ulber die Fortschritte der Agrikulturchemie von Robert Hoffmann, fur 1860–'61, S. 71.)

For experimental purposes it may be well to use these agents, but for agricultural purposes the safest and best method is to plant the grain dry. Science would indicate this as the safest, and it would seem the most in harmony with the analogies of nature, and agricultural practice is fast coming to admit it, even where it formerly practiced the reverse.

THE SECOND PERIOD OF VEGETABLE GROWTH.

The science of manuring crops more properly relates to crops during the period of their growth.

We shall therefore consider the causes operating to produce vegetable growth during this period, together with the modifying conditions under which these causes operate. For the sake of convenience, we shall divide them into causes resulting from *physical* and from *chemical* agencies.

PHYSICAL AGENCIES.

Under this head we will consider all the important agencies that affect vegetable growth which do not pertain to what is strictly called chemistry.

1. *Temperature and light.*—Vegetable life is possible only under a very limited range of temperature, and within that range it is in the highest degree sensible to the slightest thermometrical changes. These truths are too obvious to need illustration. No less sensitive is the growing plant to the influences of light. The sensitive plate in the photographer's camera is scarcely more susceptible of the influence of light and its variations than is the newly-formed carbonaceous matter in the growing vegetable cell, or the carbonic acid in the latter. During that period of the year in which the process of vegetable nutrition is most active, the most remarkable results are produced by the action of sunlight. Its rays, falling upon the grain fields, the meadows, and forests, penetrate the vegetable cell, and in these microscopic workshops convert thousands of tons of poisonous gas (carbonic acid) into elements of nutrition and of fuel for man and animals. But our means of controlling these agents are very limited. It is true we can, in greenhouses and in small gardens and hotbeds, very much modify the influence of light and heat; yet, upon the large scale this is not possible. It is possible, by applying certain kinds of manure to plants, or growing them near forests or on hills facing to the south, to get small variations of temperature, adapted to certain crops; and, in like manner, the amount of both light and heat admitted to young plants may be much modified by sowing the seed to produce them so that they may grow amongst the developed crop on the same land.

"Long manure," or that but imperfectly rotted, protects plants from cold principally by its retaining around them a stratum of warm air. Some writers have supposed that the heat evolved by the slow oxidation of the carbonaceous matter of this manure produced, in part, the effect; but such part must be infinitesimally small. The smoke of the farmer's chimney contributes almost as much to it as does the heat of this slow combustion. When the influence of light and

heat upon the decomposition of organic manure shall have been better understood, we will be prepared to say more upon this part of our subject.

2. *Moisture.*—This is one of the most important physical agents in connexion with vegetable nutrition. Plants can assimilate nutricious substances only as they are rendered capable of entering the cells of the latter in an assimilable form, and to enter the vegetable cells, elements of nutrition must be in the gaseous or liquid state. The solids and fluids must be, and the gasses may be, *in solution in water*. Water is therefore the universal solvent of the nutrient elements of plants; it acts either as pure water, or as water holding in solution certain substances by which its solvent powers are modified. No dry, solid manure, however valuable, would be of any value to the plant without water to dissolve it, and the effect of a manure in the soil is very much dependent upon the amount of moisture present to bring it into solution.

An excellent manure may fail to give a result because there is not sufficient moisture in the soil to bring it into solution, and a good crop may follow the use of a bad manure if it is preceded by a liberal supply of rain at the proper time to bring into solution the elements already in the soil. By this means farmers are often led into the most egregious errors in regard to the value of manures, and for this reason isolated recommendations of manures are of very little value. It is only when they have been tried through a series of years, or when chemical analysis has shed its light upon them, that their true value is known.

The moisture of soils has a great deal to do with the disintegration of their insoluble parts, by which the latter are rendered assimilable by plants. The constant penetration of minerals and rocks by water, with alternate freezing and thawing, breaks up and disintegrates them, setting free their potash, lime, phosphoric and silicic acids, &c., for plants. Chemical analysis informs us that the soil contains immense quantities of nitrogenous organic matter, in which the nitrogen is not in a state assimilable by plants. The constant variations of moisture to which this is subjected under varying influences of temperature serve to break up these organic compounds, and to set free carbonic and ammonia and nitric acid from them for the roots of the growing plants. In like manner manures are decomposed and moist humus products formed, which prevent the escape of their ammonia till it has reached the plants for which it is destined in the field.

The air food of plants—as oxygen, carbonic acid, ammonia, and nitric acid—are also brought down in rains, fogs, dews, &c. The recent extensive researches of Boussingault, Way, Lewis and Gilbert, and others, upon this subject, show that by this means a large part of the nitrogen required by cultivated crops is brought down to the soil annually; and if the researches of another French experimenter (M. Cloez) are confirmed by repetition, we must assume that, by the combined action of moisture and alkaline substances—such as lime, ashes, &c.—the nitrogen and oxygen of the air combine, forming nitrates, thus affording another source of nitrogen to plants.

It is of the highest importance to the farmer that an element of such vast importance as moisture in the soil should, in some measure, be under his control. Formerly it was under his control only to a very limited degree; but modern agriculture, by a judicious system of draining, and irrigation, and manuring, and subsoil ploughing, and furrowing up the soil so that air can penetrate it, has brought the control of moisture in the soil very much within the power of the farmer. Impenetrable peat bogs, arid sand plains, and sogged clays have been transformed into fruitful fields, under that magic wand, the ditcher's spade. American farmers generally pay too little attention to their boggy land. The soluble elements of nutrition from their cultivated fields are annually washed down into some neglected bog, where vast deposits of humus lock them up in combinations only to be broken up by draining the bog or haul-

ing its contents upon the dry land. The drained and well-cultivated bog may be made the most productive and valuable part of the farm.

3. *Proper cultivation.*—The conditions here involved have been pretty well anticipated in the preceding remarks upon temperature, moisture, &c. It only remains to call attention to a proper mixing of the constituents of the soil, and frequent stirrings of it. By this means its particles are comminuted, its nutriment rendered assimilable and accessible to the plant, air introduced into it, and a proper degree of moisture maintained. The earlier writers on the subject of agriculture supposed that a thorough mechanical working of the soil was competent to maintain its constant fertility. A worthy modern English divine, the Rev. S. Smith, of Lois Weeden, (see Journal of the Royal Agricultural Society, vol. XVIII, p. 39; also Lois Weeden Husbandry: James Ridgeway, Piccadilly, London, 1856,) endeavors to teach English farmers how to raise continuous crops of wheat upon the same land without manure, by substituting in its stead a most thorough tillage of the soil. It was the author's good fortune to enjoy the hospitality of this reverend gentleman during the summer of 1857, when his twelfth heavy crop of wheat, without manure, upon the same land, was nearly ready for the sickle. The crop spoke well for the theory, but science did not approve it; it has therefore failed in other hands, on other soils, as signally as it had for twelve years succeeded at Lois Weeden.

But Mr. Smith's experiments are invaluable as showing how much thorough tillage may do to break up the insoluble and unassimilable compounds of a soil and fit them for vegetable nutrition. It is entirely consistent with the teachings of science that *time for fallow, tillage, and manuring* are three things which, in agricultural practice, are, to a certain limited extent, capable of replacing one another; and the principles of rural economy must settle which of these, or how much of each, must be chosen. If labor is very cheap, manure dear, and time (that is, the interest of the money invested in land) costly, as in England, very thorough tillage should be recommended. If labor and time were dear and manures cheap, as near our cities in America, manures in abundance should be used. If manures and labor were dear and time cheap, as in the west, time should be given for the land to recover its exhausted energies. For the majority of cases, a good degree of tillage, a judicious husbandry of manures, with occasional purchases of particular kinds, and a reasonable degree of liberality in the use of the land, all combined, will give the best result.

ELEMENTS OF NUTRITION.

Important as are the effects involved in the physical agencies already considered, under the heads of temperature, light, moisture, &c., they are quite subordinate in importance to those dependent upon a proper amount of available nutrition in the soil. The former bears such relation to the latter as do the clothes that keep us warm to the food we eat. It is not necessary here to go into a detailed account of the chemical character of these elements of nutrition, as this has been already repeatedly done in the former issues of the Patent Office Report, and besides many of these details will be accessible to every one in any ordinary elementary chemical text-book. It will therefore be sufficient to confine our remarks to the agricultural part of the subject.

For practical purposes it is customary to divide the elements of vegetable nutrition into the *soil food of plants*, and the *air food of plants*.

The former embrace such substances as must be obtained by the plant from the soil; the latter such as may be obtained from the air, but which can be obtained both from the air and the soil.

AIR FOOD OF PLANTS.

The following substances are included here:

Carbon, obtained from the air either directly or through the soil in the form of carbonic acid. This element is largely consumed, but the supply is abundant, and hence it is very cheap.

Nitrogen, either absorbed directly from the air or through the soil; always in the form of some component of nitrogen, never as pure gaseous nitrogen; sparingly used; supply limited; element very dear.

Hydrogen absorbed in combination with oxygen or water, or with nitrogen as ammonia, either directly from the air or through the soil. Without agricultural value.

Oxygen, absorbed either in combination with hydrogen or pure water, with carbon as carbonic acid, or as pure gas. Without value. We might possibly add to the above chlorine, phosphorous, and sulphur, all of which form gaseous compounds that might exist in the air, but their quantity would be exceedingly small. The principal parts of the above are absorbed in solution in water by the roots of the plants.

SOIL FOOD OF PLANTS.

In summing up these we note some leading characteristics.

Phosphoric acid.—One of the most important elements, largely required by plants, rare in soils, and, though widely diffused, and in large quantities in nature, still difficult of access, and costly.

Potash.—Highly important element of nutrition, largely required by plants; rather rare in soils; universally diffused, though not abundant in sources accessible to agriculture; there is no general supply of it in the market at such price as would justify its use by the farmer, except in extreme cases.

Soda.—Unimportant as a manure, except as an indirect agent, its occurrence in plants often seemingly accidental; of no agricultural value as a direct element of manure.

Lime.—Required in large quantity by many plants, but so abundant in nature that, as a direct source of nutrition, it could be supplied at an insignificant cost. As an indirect element of nutrition it is highly important.

Magnesia.—An essential element of plants, but its universal distribution in soils deprives it of agricultural value.

Silica exists largely in cereal plants, but is very abundant in nature, and universally diffused. So far as yet investigated, it has no agricultural value, though the subject wants further investigation.

Sulphuric acid.—Much used by plants, usually rare in soils, but external sources abundant and cheap.

Chlorine.—Sparingly used by plants, rare in soils, abundant in nature, and of little agricultural importance as a direct source of nutrition to plants.

DIRECT AND INDIRECT SOURCES OF NUTRITION TO CROPS.

A substance or an element is a direct source of nutrition to crops, when it enters the plant and becomes an essential part of its organism.

Thus phosphoric acid enters the roots of the plants, and we find it helping to form proteine compounds in the grain. If animals consume the grain, these compounds will again be found in their muscles.

A substance is an *indirect source* of nutrition to crops, when through its action direct sources of nutrition are supplied to plants. Thus lime helps to break up

feldspathic rocks, and set free potash and silica for plants. It decomposes nitrogenous organic compounds and sets free available nitrogen for them.

A substance may be both a *direct* and an *indirect* source of nutrition to plants. Thus lime, while it supplies plants with potash and soda, as just indicated, also enters the plant and goes to form part of its substance. All elements that are direct sources of nutrition to plants may also be indirect sources of the same to them, since their solution in water generally increases the solvent power of that liquid. So blended are these two methods of action, that agricultural chemists sometimes differ as to whether the result attendant upon the use of a certain agent are due to direct or to indirect action; for instance, Liebig has contended that the results attained by nitrogenous manures are due to their power to bring other nutrient elements to the plant, while chemists generally consider that these results are due to the fact that these plants want the nitrogen of the nitrogenous manures to form part of their substance.

AIR FOOD OF PLANTS.

Special nutrient qualities.—The air food of plants principally consists of carbonic acid, volatile nitrogenous compounds, and water. These substances form, with very slight exception, all the plant, except the ash.

Water.—While water is a most important direct element of nutrition to plants, its principal office is that of an indirect source of nutrition to them. It differs from solid indirect agents, in being able to enter the plant, perform its mission, and leave it again. It is a veritable *vegetable omnibus*, in which all the elements of nutrition are crowded, that it may bear them to their respective places in the vegetable organism.

While only about 40 parts of the dry matter of plants are composed of the elements of water, the extended experiments of Mr. Lawes, at Rothamsted, England, have shown that, with our cultivated crops, about 150 parts of water pass through the plant for one part of dry matter *fixed* in it; hence there must be about 400 parts of water enter the plant as an *indirect* to one that enters as a *direct* source of nutrition to crops. This large quantity of water carries the phosphates, sulphates, silicates, carbonates of potash, lime, magnesia, &c., *in solution* from the soil to the different parts of the plant. Some of these substances are quite insoluble, and were it not that we know these large quantities of water pass through the plant, it would be difficult to explain how they reached its several organs.

A few simple data will enable us to see the relation between the amount of each nutrient element required by the plant and the amount of water passing through the plant to bear it to the latter.

To ascertain this we must know—

1. The relation between the quantities of grain and straw produced by a given plant.
2. The percentage of ash yielded by each.
3. The percentage composition of the ash of each.
4. The ratio between the amount of water passing and the amount of water fixed in the plant; also the amount of nitrogen, carbon, &c., in this matter.

The following table exhibits results drawn from such data:

	Approximate relation of grain to straw corresponding.*	Ash in 100 parts of grain, and the straw corresponding.†	AMOUNT OF THE MOST IMPORTANT ASH CONSTITUENTS IN 100 PARTS OF GRAIN, AND THE CORRESPONDING AMOUNT OF STRAW.‡							
			Potash.	Soda.	Lime.	Magnesia.	Phosphoric acid.	Sulphuric acid.	Silica	Nitrogen.
Wheat	100	1.98	.59	.00	.059	.282	.94	.020	.024	2.00
Straw.....	300	13.74	2.05	.412	.540	.137	.54	.134	9.59	1.50
Sum	400	15.72	2.64	.412	.599	.419	1.48	.154	9.83	3.50
¼ sum§	100	3.93	.66	.103	.149	.105	.37	.038	2.46	.87
Rye	100	2.00	0.66	.00	.06	.22	.94	.01	.04	1.98
Straw.....	300	13.26	2.65	.00	.66	.20	.30	.29	8 80	1.50
Sum	400	15.26	3.31	.00	.72	.42	1.24	.30	8.84	3.48
¼ sum§	100	3.81	.83	.00	.18	.10	.31	.07	2.21	.87
Oats	100	3.80	.49	.00	.15	.31	.54	.004	2.12	2.20
Straw.....	200	14.48	3.75	.72	1.20	.40	.40	.62	5.88	1.20
Sum	300	18.28	4.24	.72	1.35	.71	.94	.624	8.00	3.40
⅓ sum§	....	6.09	1.41	.24	.45	.23	.31	.208	2.66	1.13
Maize.....	100	1.51	.42	.00	.02	.25	.75	.03	.02	1.80
Stalk, &c....	140	5.04	.50	1.26	.31	.30	.83	.06	1.26	.70
Sum	240	6.55	.92	1.26	.33	.55	1.58	.09	1.28	2.50
$\frac{5}{12}$ sum§	100	2.72	.38	.52	.13	.23	.16	.04	.53	1.04

* This relation is an approximation to that of Schweitzer, extracted from the Yahrbuch fur die Deutschen Hause u Landwirthe, page 122; 1859. The ratio is evidently too high for the straw in some of these, but it will answer for illustration.

† These are taken from a number of averages given on page 131, vol. I, of E. Wolff's "Naturgesetzlichen Grundlagen dos Ackerpaues."

‡ Principally collected from Wolf, page 140. The maize from Liebig's Yahresbericht, vol. III, page 661, by Way & Ogston, &c., from the Patent Office Report for 1860.

§ It will be seen that these fractions of the sum show how much ash and how much of each ash constituent corresponds to 100 dry matter of grain and straw; and from these data we can easily form the following table, which shows the amount of water passing through the plant for one part of ash and one part of each constituent of ash.

Amount of water of one part of each element given in—	AMOUNT OF WATER PASSING INTO PLANTS TO ONE OF—								
	Ash.	Potash.	Soda.	Lime.	Magnesia.	Phosphoric acid.	Sulphuric acid.	Silica.	Nitrogen.
Wheat	3800	22700	145000	100700	142800	40500	394700	6090	77200
Rye	3900	18000	.....	83300	150000	48400	214200	6780	77200
Oats.....	2400	10600	62500	33300	65217	48400	72100	5640	73300
Maize	5500	39500	28800	115300	62217	22700	375000	28100	74400

The numbers just given may be considered as approximations to the truth. But, with a very wide range of variation, there will still always remain the fact that, for each part of every element required by the plant, there is an immense amount of water passes through it.

With rye, oats, and wheat, there are over 40,000 pounds, or 133 barrels, of water passes through the plant for every pound of phosphoric acid required by it.

Quantities so large are sufficient to bring to the plant, from its most insoluble compounds, all the phosphoric acid that is required in vegetable growth, providing these compounds are well distributed in sufficient quantity in the soil, and the water is sufficiently long in contact with them to become saturated. The same considerations apply, though with somewhat different force, to potash, silica, and the other elements, as a glance at the table will show.

Owing to the fact that this water cannot always be saturated, and still further to the fact that at certain periods of the plant's growth it requires all its nutrient elements in much larger quantities than at others, it is necessary either to have a large excess of plant food of an insoluble kind or a less quantity of a soluble kind in a soil, that the plant may get sufficient food at these times of its greatest demand for it. If we were to cut, weigh, and analyze any of our annual crops at successive periods through their growth, so as to find the amount of plant-food used during each week of its growth, we would find that a very large part of it was used during the growing weeks of June and July. We would also find that rain water, very soon after it reached the soil, was absorbed by plants, and hence insoluble manures, as coarsely ground bones, could not saturate it in time to afford a sufficient supply of nutrient matter.

Since the recent observations and researches of Messrs. Thompson, Huxtable, and Way (see Journal of the Royal Agricultural Society of England) upon the absorbent power of soils and the consequent comparatively insoluble state in which these nutrient elements exist, Liebig has advanced a peculiar theory of vegetable nutrition. On the assumption that plant food is in an insoluble state in the soil, he supposes that the roots lay hold of it in the solid form and assimilate it; and he even goes so far as to suppose that solutions of vegetable nutriment, presented to the roots, would destroy the plant.—(Letters on Modern Agriculture, 1859, p. 38.) It need hardly be said a theory so remarkable has found no advocates except its distinguished author. It, however, would not be denied that the immediate contact of the growing rootlet with an insoluble element might accelerate its solution.

CARBON AND CARBONACEOUS MANURES.

A great deal has been written and the most diverse opinions entertained by scientific and practical men upon the nutrient value of carbon in manures. The great names of Mulder and Liebig are upon opposite sides in this contest.

Mulder, and after him a number of French experimenters, contend that carbon, in the form of humus, is of vast importance as a direct source of nutriment to crops, (this is also the idea generally entertained by practical men,) while Liebig, and modern agricultural chemists generally, contend that it is only valuable as a direct source of nutrition to crops, by affording them carbonic acid.

In 1859 Liebig says, (Letters on Modern Agriculture, p. 51,) "Without raising doubts of the efficacy in certain cases of the organic matter, it may be asserted that nobody who possesses any knowledge of the matter now believes that the produce of a field in carbonaceous substances bears any proportion to the amount of humus in the soil, and that its fertility can in reality be estimated, as was formerly supposed, by this humus."

No one could deny that the crop was influenced by the humus in the soil; that it was a *function* of a number of things, of which the carbonaceous matter in the soil was one. We have already seen that there can be no definite proportion between the amount of any one substance affording a producing cause to the soil and the total crop produced. Humus may sometimes afford positive and sometimes negative causes injurious to vegetation, to the sum total of cause producing the crop, and so may any other substance that is a direct or indirect source of nutriment to plants.

In regard to the *sources of carbon* to plants, we know—1. That a very large amount of carbonic acid exists in the air above and in the soil, and that it is largely absorbed by water, and hence that it exists in all the immense quantities of this fluid that pass through the plant. The quantity thus taken through the plant in solution, as a gas, would be more than sufficient to form all the carbon products of the plant. In addition to this will be the carbonic acid of numerous carbonates, also taken up in the water. 2. We know that plants can decompose carbonic acid afforded them in aqueous solution with the greatest facility, using their carbon to help form starch, cellulose, &c., and setting free the oxygen. 3. Plants grown in a soil deprived of all its organic matter, but supplied with all the other conditions of vegetable growth, grow with nearly as much vigor as those growing in soils containing organic matter. The slight difference may be ascribed to the better physical condition of soil caused by the organic matter.

Whether or not plants can absorb and fix carbon from humus and other like organic products of vegetable decomposition in the soil bears so directly upon the question of manures that it deserves our close attention.

Mulder first made extensive investigations upon the organic matter of soils. He gives the following names to organic substances found in them. They are given in the order of their formation during vegetable decomposition: humin and ulmin, humic, ulmic, geic, crenic, and apocrenic acids. He supposed there might be other intermediate products. These acids combine with the potash, soda, lime, and ammonia in the soil, and Mulder supposed the salts thus formed entered the plant, the carbon of the acids going to form its carbon compounds, and the basis to form its ash constituents and nitrogenous products.—(See Mulder's Vegetable and Animal Physiology, translated by Dr. Fromberg, p. 146.)

In 1840 M. Th. de Sousure attempted to answer the following question, proposed by the Scientific Congress in France: "Can the *ternary* and *quarternary* compounds," (non-nitrogenous and nitrogenous organic matter,) "after they have been absorbed by the roots of plants, be assimilated?"—(Ann. de Chem., XL., p. 275.) He found that plants grew well in solutions of humate of ammonia, and that the humus disappeared in them; and hence he inferred the above views of Mulder were correct.

Liebig, however, with good reason, objected (Ann. de Chem., XL., 291) that the facts did not justify the conclusions, and explained the results by assuming that the humus simply afforded, by its decomposition, carbonic acid and ammonia to the plants. Further experiments by Weigmann and Polsdorf show that vessels containing humatis lose very little more of that humus with plants growing in them than without plants, thus confirming Liebig's view. On the contrary, in 1849, M. Soubeiran, in a paper presented to the Central Agricultural Society of the lower Seine, gave a long series of investigations, the tenor of which was to attach a high degree of importance to humus, (Jour. Pr. Chem., L., 429.) This investigation received the prize of 1,500 francs from the society. A German writer (Wolff) truly says of it that it proved nothing except that a man in France can get a prize for an investigation which establishes nothing that it attempts to establish!

Malaguti and others, in France, have since made investigations which seem to go to sustain Mulder's views of the importance of humus. But they all are liable to the objections of Liebig, stated above, while we have the most abundant proofs that plants are not *dependent* upon carbon from this source. So that there is not the slightest ground for the declaration of a recent French writer (Rohard, Guide de la Fabrication Economique des Engrois, p. 165) on manures, that all manures incapable of furnishing humus to the soil are *imperfect* or *incomplete*, and hence, if used, "will ultimately deprive the soil of its natural fertility."

It is not on the small scale, usually adopted in scientific experiments alone, that we have evidence of the power of the plant to grow without getting its carbon from the humus products.

Every one familiar with the use of guano upon the non-calcareous (silicious) sterile soils of our palæozoic rocks knows that large crops can be raised with four hundred pounds guano to the acre, and yet there is more organic matter left in the soil after their growth than before.

And Mr. Lawes has, for sixteen years in succession, grown heavy crops of grain upon his farm at Rotamsted, England, without adding a pound of organic matter. Tons of carbon have been removed from the soil without any being supplied to it in manure, the only manure used being the ash constituents of plants, &c., the salts of ammonia. On the other hand, Mr. Lawes manured fields with various kinds of organic manures, as far as possible destitute of ash constituents and nitrogen, (as rice oil, sawdust, &c.,) and the result was, no appreciable increase of crops, thus showing that the organic manures are valuable for their ash constituents and ammonia.

In other words, except for the indirect action of carbonaceous matter in stable manures, the ashes of the latter mixed with an amount of nitrogen, in the form of a soluble salt equal to that in the manure before burning, would be equal in value to the manure itself. Indeed, in view of the fact that, in the decomposition of nitrogenous vegetable matter, some of the nitrogen is evolved as *free nitrogen*, and some passed into an unassimilable condition like that in soils, the above compound, if ashes and nitrogenous salt, would be more valuable than the unburned manure.

A very large number of recent experiments, made by agricultural chemists in Europe, go to confirm the opinions entertained above.

Grouven and Pingen (Zeitschriftdes Landwirthschaftlichen Vereins fur Rhein Preussin, 1860, p. 77) found, in raising beets, that one thousand pounds of horse or cow manure did not produce as much crop as twelve pounds of potash or soda, saltpetre, or 800 pounds cow urine.

Stockhardt, of Tharandt, (Die Chemische Ackersmann, 1860,) obtained the following results with the manures named:

	I.	II.	III.
No manure	127	157	79
300 pounds molasses, burned to coal	141	157	82
300 pounds molasses, fresh	190	184	104
Bone dust and saltpetre	238	266	

There does seem to be a result above in favor of the organic matter of the molasses, as shown by the difference of results with this article, burned and unburned. But the physical difference between the state in which the ash and nitrogenous compounds exist in each may account for this difference, and Robert Hoffman (Central-blatt fur die gesampt Landeskultur, 1860, S. 265) has shown that the direct action is due to the nitrogen (about 1 per cent.) and the mineral matter (about 8 per cent.) in the molasses.

The result with bone dust and saltpetre points to the same conclusion. C. Stammer, (Dingler's Pol. Jr. Bd. ILVII, S. 453,) in a series of experiments with beets upon twelve acres of land, obtained similar results as to the effect of organic manures. And John Dove (Highland Agricultural Society of Scotland) has recently made very extensive experiments with manures, which enable us to compare rape cake with several non-carbonaceous manures. He found with oats four hundred weight of rape cake per acre gave less crops than no manure, while guano and saltpetre increased the crop one-half. With barley a similar result was obtained with the cake, but not so much increase with the nitrogenous manures. With wheat the cake gave a slight increase, but not so much

as the nitrogenous manures. With beans but little effect was produced by cake or guano. With potatoes and turnips the most favorable results were obtained by rape cake, but they were still less than those given by the nitrogenous manures.

And, quite recently, Lawes and Gilbert have obtained results with rape cake similar to the above. These facts, strange as it may seem to the practical man, certainly show that the organic matter of soils and manures is not indispensable to vegetable growth. On the other hand, there is an abundance of facts that show it does very often exert a very beneficial influence upon the soil and crops, but the manner in which it acts is very imperfectly understood. There is no subject in chemistry more complicated than that of the decomposition of organic matter. And no subject in agricultural chemistry is more difficult to understand than the precise relation of the decomposing organic matter of soils to vegetable growth. We do not even know what organic matter exists in soils, nor what are the processes of their formation.

We have a definite knowledge of the constitution of the principal part of plants before decomposition commences in the soil, as also of the ultimate products of that decomposition, but between these points there is much obscurity.

Mulder attempted, with great labor, to trace the process from one point to the other. He found six or eight intermediary products; but others, repeating his experiments, have found more, and those found not always identical with his, and no experimenter finds any two sources of decomposition giving the same result. And when we reflect that all the different varieties of stone coal, all the gases of coal mines, cesspools and peat bogs, and of sewers and manures, and all the numerous products from the so-called oil-wells, so much used recently for light, are ultimate or intermediate products of vegetable decomposition, we see the magnitude and the complicated character of the subject.

Under some circumstances the transformation of vegetable matter into its ultimate products is very rapid; in others, thousands of years do not suffice to effect it. The age of vegetable matter in soils may vary from that but yesterday introduced to that introduced generations ago.

In some cases the nitrogen of the vegetable matter passes into ammoniac salts; in others, into nitrates. A portion is sometimes set free as pure gas, and a large portion remains for a very long time in an insoluble and unassimilable condition in the soil. All these processes most probably take place during vegetable decomposition in the soil. Some experimenters have supposed that, by some undefined process, the ozone of the air, in the presence of decomposing vegetable matter, may oxidize the nitrogen of the air, and form nitric acid. And others (Mulder principally) have assumed, with much confidence, that under the influence of the nascent hydrogen evolved during vegetable decomposition, in the presence of the gaseous nitrogen of the atmosphere, ammonia may be formed. It is, however, very improbable that either of the last two processes take place. The first is a *mere suggestion*, and there are no facts that justify Mulder's confident assertion of the last.

By chemical examination of the organic matter of soils at different periods we may learn something about the nature of the products of decomposed vegetable matter in them; but our methods of analysis are too imperfect to throw much light upon the subject. We are not always certain that some of the products we seem to find in soils are but the result of the action of our chemical reagents upon the latter. And when we have, by chemical process, distinguished certain vegetable products, and named them, as Mulder, Johnston, and others have done, we are utterly at a loss to know in what physiological, physical, and chemical relation they stand to the growing plant and its nutrient elements in the soil. We know that, as porous bodies and acids, they absorb food from the air and from water; as acids, they neutralize nutrient bases; as fer-

menting organic bodies and as acids, they help to break up insoluble compounds, and appropriate or set free the plant nutriment they contain. In this way bones may be made to give up their phosphoric acid, insoluble nitrogen compounds their nitrogen, feldspathic rocks their potash, &c. Organic matter, particularly that of imperfectly decomposed stable manure, with much straw in it, by decomposing in the soil, continually keeps the particles of the latter in motion, crumbling down to occupy the space left by the manure, thus subjecting the rootlets to a continued tillage.

But of the intensity of all this physical and indirect action, or under what circumstances it may produce products poisonous to the plant, or which will foster insects and vermin destructive to vegetation—of all these things we are very much in ignorance.

Recent researches of Liebig, Way, and others, have thrown some light upon the part played by the organic matter in soils; upon which Liebig has founded his new and most remarkable theory of vegetable nutrition. These researches have hardly been sufficiently extended to enable us to generalize from them. They would indicate, however, that the organic matter of soils possesses the very peculiar power of abstracting nutrient elements from solutions passing through them, while they not only allow the non-nutrient elements to pass through, but they give up to solution such of these elements as they may already have. By some means or other, not yet clear, the nutrient matter thus absorbed is given to the plant.

On the other hand, there are no doubt cases in which the vegetable matter of soils is decidedly injurious to them. There can be no doubt of this in regard to peaty soils, and the same causes which in this case are so evidently operative may, in a disguised form, be more or less active in every soil.

It may yet be found that the reason the rich Peruvian guanos, and other concentrated manures, do not produce more effect upon soil rich in organic matter is, not that they do not bring the requisite plant-food to the soil, but because the soil embraces conditions which render the food unassimilable. Experiment proves that a limited quantity of soluble plant-food, as the sulphate of ammonia, will be of more service to a plant in a soil destitute of organic matter, than in one rich in organic matter, and that the same limited amount will be more valuable in a small portion than in a large portion of soil, and that the plant can assimilate the greatest possible amount of this limited quantity from an aqueous solution without either soil or organic matter to appropriate it. The beneficial action of lime, of thorough tillage, and of draining, upon soils is no doubt due, in great part, to the breaking up of some of these organic compounds which lock up the plant food. The Rev. S. Smith, of Lois Weeden, England, obtained excellent crops of wheat for many years in succession on the same land by thorough tillage alone.—(See Lois Weeden Husbandry, James Ridgeway, Picadilly, London, 1856.) Every one knows how fertile reclaimed swamps and peat bogs are, and the beneficial action of lime upon soils is universally admitted, and yet all these agents are indirect; they do not bring nutrient matter to the soil, but act solely by rendering what is there assimilable, or by producing conditions for its absorption from the air.

It is not possible here to discuss in detail all the bearings of this part of the question, or to give the different views of scientific men upon it, but enough has been said to point out its importance and to exhibit its main features, and show how much we have yet to learn in regard to it.

We will add the following:

ANALYSIS OF STABLE MANURE FROM THIRTY HORSES, THIRTY-SIX CATTLE, AND SIXTEEN HOGS, WITH STRAW FOR BEDDING.—[Wolff's Ackerbau, B. I., 389.]

	FRESH MANURE.		OLD MANURE.	
	Dry.	Moist.	Dry.	Moist.
Carbon	42.3	9.4	35.5	7.41
Hydrogen	5.0	1.2	4.2	0.87
Oxygen	36.7	8.2	25.8	5.34
Nitrogen	1.9	0.4	2.0	0.41
Ash	14.1	3.2	32.2	6.67
Water	0.0	77.6	0.0	79.30
	100.0	100.0	100.0	100.0

The foregoing considerations show that in this old manure, (moist,) as it is usually taken to the field by the farmer, only about 7 per cent. (the ash, &c., nitrogen) is really valuable for direct nutrition, the remaining 93 per cent. being water and carbonaceous substances. Our next view will show that even this small per cent. is composed of substances many of which have no agricultural value. It is because of this large per cent. of valueless matter, with the small quantity of plant nutriment in stable manure, that it will not pay the farmer to haul the latter a great distance, for the cost of transporting the water, carbon, oxygen, &c., soon exceeds the value of the nitrogen and the ash, while concentrated manure can be transported over continents and across oceans with profit.

NITROGEN.

Nitrogenous manures have the very highest degree of importance, both because of their value to the farmer, and of the varied and extended researches and discussions in relation to their agricultural value, and the sources of nitrogen to plants that have been made by scientific and practical men for the last twenty years. All the other elements of nutrition together have not been the cause of so much discussion as this one. The most diverse opinions have been maintained with the most remarkable persistency, both as to its importance as an element in manures and as to its sources of supply to plants.

It would lead us too far from our subject to discuss these differences of opinion. And as they have been noticed in former reports of the Patent Office, we shall content ourselves with giving the principles involved as the subject now seems to stand.

1. Nitrogenous manures are of the very highest importance in agricultural practice, whether the nitrogen be in the form of ammonia, nitric acid, or any of the complicated nitrogenous organic compounds. The commercial value of assimilable nitrogen in manures is greater than that of any other substance.

2. The action of nitrogenous manures upon crops is such as can only be satisfactorily explained on the assumption that they afford a source of available nitrogen to the growing plant.

It matters not in what form the nitrogen be afforded to the plant, so that it is assimilable. The two very diverse forms, ammonia (formed under reducing forces, and broken up under oxidizing forces) and nitric acid, (formed under oxidizing forces, and broken up under reducing forces,) alike accelerate the growth of plants, as also do the indifferent nitrogenous compounds.

An immense number of experiments performed in Germany, France, England, and America confirm this view, while some results militate against it; but when we reflect that there exists in nearly all soils conditions in which tons of nitrogen are rendered not assimilable, it may readily be supposed that these conditions modify the action of diverse nitrogenous compounds in some instances so as to produce the anomalous result in question.

3. The only direct source of nitrogen to plants is that of combined nitrogen. Plants are unable to abstract a particle of nitrogen from the gaseous nitrogen of the air. They can absorb and assimilate nitrogen in a great variety of its combinations, but the salts of ammonia and nitric acid are the most general forms in which they take it up, and all the complicated nitrogenous compounds of the soil are probably reduced by decomposition to these simple salts before assimilation.

4. During the growth of plants and the consequent absorption of nitrogen compounds, and the fixation of nitrogen in the plant, no free nitrogen is evolved from the compounds absorbed,

5. Nitrogenous organic matter, during the process of decomposition, is liable to evolve free nitrogen. The circumstances of this evolution are not well understood, although the part evolved may amount to 30 per cent. of the total quantity present; such being the case, the nitrogen, in its more complex compounds, is not as valuable as an equivalent amount in the form of a simple ammonia, salt, or nitrate. A very small part of the nitrogen passes into the form of ammonia, salts, or nitrates; the principal part of it remains a long time in an insoluble condition, as indicated below; (see 8.)

6. The gaseous nitrogen and oxygen of the air do, under certain circumstances, combine, and, with bases, form nitrates, which afford vegetable food to plants.

7. The air contains small quantities of ammonia and nitric acid that are brought down to soils in rain, dews, fogs, &c., by simple absorption. The amount thus afforded is quite insufficient in agricultural practice, and hence the value of nitrogenous manures.

8. Large quantities of nitrogen exist in soils in a condition not assimilable by plants. The state in which they exist is involved in all the difficulties associated with the question of the organic matter in soils, and hence is not well understood.

9. Cereal plants (oats, wheat, barley, maize, &c.) are especially benefited by nitrogenous manures. They do not seem to have the power of obtaining nitrogen in circumstances where leguminous plants (peas, beans, clover, &c.) obtain it in abundance. Hence the necessity, in part, of alternating cereal and leguminous crops.

The foregoing considerations, briefly stated, show the importance of the nitrogen question to the farmer. The commercial value of manures affording nitrogen, the necessity of adding it to the soil, its limited supply in nature, its liability to total loss by the evolution of gaseous nitrogen in the decomposition of vegetable matter, the volatility of some of its compounds, and the solubility of others, by which it may pass off in the air or be washed away by rains, together with the fact that the soil contains tons of it in an unassimilable condition, all tend to make the nitrogen question one of the highest, scientific, and practical interest. There is yet much to be learned in regard to nitrogenous matter before we can give the farmer complete rules for the purpose of

making the best possible use of the nitrogen at his disposal in the soil and in manures.

It has long been known that lime and wood ashes mixed with old manures cause the evolution of ammonia; but the objection does not hold against fresh manures, as these contain but little ammonia. The presence of lime may hasten decomposition, and induce a tendency to the formation of nitrates, which are non-volatile.

It is also known that manures should not be subjected to washing rains, as by these the nitrates and ammonia salts will be removed. Dr. Voelcker has shown that there is much more danger of deterioration from this cause than from the volatilization of the ammonia salts, since only a very small quantity of the nitrogen of the manure exists in it, in the form of ammonia salt, even though the odor of ammonia be distinctly recognizable near the manure heaps.

The influence of lime and ashes upon nitrogenous manure has not been sufficiently studied; nor have the circumstances attendant upon the decomposition of nitrogenous organic matter, by which nitrogen gas is evolved, received that degree of attention which the subject should receive. Chemists have been pointing to the traces of nitrogen that pass off as ammonia, and calling on the farmer to save it, while hundred-weights of it are silently slipping away as nitrogen gas, and tons of it are taking a long nap in the soil, totally indifferent to the necessities of the plant, the roots of which penetrate it. One of the beneficial influences of lime upon land is due to its action upon the nitrogenous products of the latter.

We have already remarked that there was more danger of manures suffering by having nutrient matter washed out of them than by volatilization. A very important part of the plant-food of manures is soluble in water when voided by the animal, and a larger portion is already in solution.

Boussingault (Chemie Agricole, page 22) found the following results in regard to manures voided in twenty-four hours by the animals named in the table below. The figures indicate grammes:

	FRESH.		DRY MATTER.		NITROGEN—IN		SALTS AND EARTHS.	
	Urine.	Excrement.	Urine.	Excrement.	Urine.	Excrement.	Urine.	Excrement.
Horse	1,330	14,250	302	3,523	37.8	77.6	110.0	574.6
Cow	8,200	28,413	960	4,000	36.0	92.0	38.4	480.0
Swine	3,050	1,380	63	208	6.9	9.2	31.2	84.4
Man*	1,200	150	40	38	8.6	1.5	9.7	9.0

* See Lehman's Phiseologische Chem. and Pelouze & Tremy's Trait de Chemie., vi, 177.

A glance at the above table will show how very large a per cent. of plant-food is contained in the urine of those manures upon which the farmer depends to maintain the fertility of his fields. Although the fresh excrements of the horse, cow, and swine greatly exceed the urine, the difference of dry matter is not so great; that of the nitrogen is still less.

A large percentage of these excrements is also soluble in water. And if stables and manure-yards are exposed to washing rains, it will all be borne off with the urine and lost.

But, before considering this, let us look a little more closely into the composition of the salts and earths or the ash of these manures. The following table will exhibit the per cent. of the most important nutrient elements in the ash of the several manures considered:

TABLE.

	HORSE.		OX.		SWINE.		MAN.	
	Urine.*	Excrements.‡	Urine.*	Excrements.†	Urine.*	Excrements.†	Urine.‡	Excrements.‡
Lime	6.80	4.03	.67	5.71	.....	2.03	1.15	26.46
Magnesia	4.78	.....	3.93	.....	.....	.....	1.34	10.54
Potash	30.62	11.30	59.18	2.91	8.03	3.60	13.64	6.10
Soda	13.24	1.98	0.98	0.98	13.00	3.44	1.33	5.07
Common salt	6.94	0.03	0.30	0.23	53.00	0.89	67.26	4.33
Phosphoric acid	..00	1.40	.....	4.20	10.00	4.90	11.21	36.03
Silicic acid	.55	62.40	0.35	62.54	.....	13.19	.00	0.00
Sulphuric acid	6.01	.....	6.30	.....	3.00	.....	4.06	3.13
Earthy phosphates	.....	.....	.....	.....	8.80	.....	.....	.....

* Fromberg Wolff's Ackerbau, I, 394.
† John Rodgers's Ann. Chem. Pharm., LXV, 85.
‡ Porter's Ann. Chem. Pharm., LXXI, 109.

A glance at the above table will show that the principal valuable element in urine, besides nitrogen, is potash, while the excrements contain phosphoric acid. It is of the utmost importance to the farmer that both these elements of nutrition be brought upon his land.

In ordinary cases, where large quantities of straw are used for bedding animals in dry stables or stalls, the straw will be quite sufficient to absorb all the urine above that which evaporates, and no loss will occur. But, on the contrary, if the manure, either during the time of formation or afterwards, be exposed to rains, particularly if that from the roofs of buildings fall upon it, or streams of water run through the yard, all the nutrient elements of the urine and a great portion of the easily assimilable part of the excrements will be washed away. The organic mass left behind, deprived of a large part of its assimilable nitrogen, phosphoric acid, potash, &c., &c., will not be half as valuable as the original. Indeed it may be so wasted as to be little better than an equal weight of pine shavings. Dr. Voelcker, chemist of the Royal Agricultural Society of England, and professor of chemistry at the Royal Agricultural College of Cirencester, has made extended and able researches (see Journal of Royal Agricultural Society, 1856 and 1857) upon this subject in regard to manures in England, and he shows conclusively—1st. That the manure exposed to the weather loses the principal part of its assimilable plant-food; 2d. That the washings from it contain a very large part of this food.

But the loss sustained by the American farmers is liable to be much greater than that of the English farmer. Our rains are more violent, and our large barns, which pour all the rain they collect into the manure-yard in front of them, are unknown out of America.

PHOSPHORIC ACID.

This stands next to nitrogen in practical importance to the farmer. It is very generally deficient in soils, in an assimilable condition, though a large constituent of cultivated crops. And although it is quite abundant in nature, yet such is the labor of fitting it for the soil that it constitutes an expensive element. It derives especial interest from the fact that it is one of the very few nutrient elements for plants, the demand for which has given rise to extensive establishments, with the investment of much capital, for its preparation for sale to farmers.

Millions of dollars are now invested in this country and Europe in the preparation of phosphates for agricultural purposes. As its importance is almost universally admitted, there are few diverse opinions to consider in regard to it. It should, however, be remarked that some practical men and manure manufacturers, and even agricultural editors, hold very erroneous views in regard to the value of phosphates, or, rather, the source of their value. They contend that the value is due to the nitrogen the phosphate contains, and hence non-nitrogenous phosphates are valueless. Now, the best of bones contain only about 4 to 5 per cent. nitrogen, and weathered bones may contain only half this amount. Bones used for making glue contain but about 2 per cent. nitrogen, (Hellriegel,) and superphosphate, made from fresh bones, could only contain about 1 to 2 per cent. nitrogen. And this nitrogen is a great part in that peculiar form, in passing from which to an assimilable form it is liable to loss in all the ways we have considered under the head of Nitrogen.

Suppose the farmer purchase a ton of superphosphate, containing 2 per cent. of this nitrogen, for $40. He thus gets 40 pounds of nitrogen; in the process of decomposition one-third, at least, of this nitrogen is liable to loss by the evolution of free nitrogen and by passing into the unassimilable condition of nitrogen in soils, so that there remains about 28 pounds for his $40.

Now, nitrogen in sulphate of ammonia can be bought for 18 cents per pound, and in Peruvian guano it will not cost over 15 cents. This leads us to the conclusion that farmers ought not to buy bones at all, when sulphate of ammonia is to be obtained; but the conclusion is false, as shown by the success attendant upon the use of bones, and hence the premises are faulty. Nitrogen adds to the value of phosphates, but it is not even the *principal* source of their value, much less the only source. Indeed, the value of nitrogen in bone superphosphates is considered of so little importance in England, owing to its small quantity, that no account is taken of it in estimating the value of some of the best superphosphates. There are experiments recorded that would indicate that phosphoric acid was not of practical value in increasing the amount of crops, but such experiments may be found in regard to every nutrient element. It is enough to say that Lawes and Gilbert, Dr. Voelcker and Professor Way, in England; Stockhardt, Liebig, and all the other agricultural chemists of Germany; Boussingalt, Barrel, and others, in France; and Johnson, Booth, and others, in America, all agree upon this subject of the importance of phosphoric acid, and, with their decision in its favor, we may leave the question of its value.

Aside from that in manures the most immediate source of phosphoric acid to farmers is the phosphate of lime in bones. The latter contain about 4 to 5 per cent. of nitrogen, and about 46 to 50 per cent. of phosphate of lime. If the fresh bones be broken up finely and drenched with water, the fermentation of the organic matter in them is such that considerable portions of the phosphate will pass into solution, and no doubt if bones, thus finely divided, were mixed with the soil, they would give up an abundance of phosphoric acid to plants. But, owing to the difficulty of grinding fresh bones finely, and the insolubility of the little solid pieces, it is best to dissolve them by some chemical process.

Sulphuric acid is usually used for this purpose. This acid, when poured on the ground bones, unites with the lime of the latter, and sets soluble phosphoric acid free.

Many chemists have assumed that if sufficient sulphuric acid were used to take one of the three atoms of lime from the phosphoric acid, the other two would with it form the so-called soluble bi-phosphate of lime.

But Weber (Pogg. Annalen, B. CIX, S. 505) has shown that such is not the case, but that three atoms of sulphuric acid will take three atoms of lime from one atom of the bone phosphate; instead of one atom from each of three atoms

of phosphate, so that we will have one atom of free phosphoric acid instead of three atoms of bi-phosphate of lime, [3 SO_3, HO+3 (3 CaO, PO_5)=3 CaO, SO_5 =3 CaO, SO_3+ 3 HO, PO_5 instead of 3 (SO, HO_5)+3 (3 CaO, PO_5)=3 CaO, SO_3+3 (2 CaO, PO_5)] and in regard to the question whether the free phosphoric acid thus formed would not act on the bone phosphate and pass into bi-phosphate, converting two atoms of bone into bi-phosphate, he says the action by which this 3 HO, PO_5+2 (3 CaO, PO_5)=3 (2 CaO, PO_5)+3 HO would take place is very weak.

Such being the case, it will take three times as much sulphuric acid to decompose bone phosphate as on the supposition the bi-phosphate is formed.

Fresh bones contain in 100 parts about the following composition:

Moisture	6
Organic substances	31
Bone phosphate	47
Carbonate of lime	8
Other salts	2
Sand	6
	100

Giving about 30 of lime, which would require to form sulphate of lime and set free phosphoric acid, 84 parts of sulphuric acid of specific gravity 1.5.

The 31 of organic matter and the 2 of other salts would also consume some acid, so that between 90 and 100 would be requisite for the decomposition of 100 of bones. It would, however, be more economical to use enough of acid to set free about two-thirds of the phosphoric acid, and leave the other third for use by the plant at a later period of its growth.

If farmers are near a superphosphate manufactory, they should be able to sell their bones and buy superphosphate cheaper than make it themselves with sulphuric acid. On the contrary, if transportation involves much cost, they should pound up their bones, and throw them into a tight, low box made of planks, and then mix oil of vitriol with its weight of water, and pour it upon the bones. About 40 parts of oil of vitriol to 100 of bones will answer. Let the mass stand for some days, the longer the better, and it will be ready for use.

Another method is to mix the fresh pounded bones with carbonate of potash or wood ashes. Carbonate of lime and soluble phosphate of potash will form, and, after six weeks or two months, the mass may be used.

Another plan recommended is to throw the bones into a hole, with fermenting manure, decaying dead animals, or any similar substance. Let them lie from three to six months, and then haul all out together. The bones will be decomposed.

In all cases care should be taken to let no bones be wasted. They are as important a part of the produce of the farm as the wheat in the granary or the hay in the stack.

POTASH.

This substance ranks third in degree of importance to the farmer as a nutrient element to crops. Although universally diffused in nature in the ashes of plants, there are no great deposits of it accessible to the agriculturist, and such is the cost of the commercial article, that there will be few cases in which it would remunerate the farmer to purchase it in the market. He has, however, in wood ashes a limited supply at home. This should either be mixed with bones, or as directed under the head of phosphoric acid, and then used with the

latter, or it should be at once applied to the land in the latter method, especially to leguminous crops.

SULPHURIC ACID.

There are very few soils that may not be benefited by sulphates, as gypsum, but this latter article is so cheap and so easily obtained, and the mode of its application so well understood, that little need be said in regard to it here. The vulgar idea that it poisons land or is injurious to it has, it is hoped, been so far removed from the minds of farmers by modern scientific discussions as not to need notice. If superphosphates are used, they will bring gypsum to the soil in sufficient quantities for practice.

LIME.

This agent, as already intimated, is more an indirect than a direct source of nutrient matter to crops. It does not bring plant-food to the soil, but fits that which is there for vegetable nutrition, and produces physical conditions in the soil that enable the plant to get the prepared plant-food. It is always a question to be decided by the circumstances of the case whether it is better to purchase plant-food in the market, or to use lime to render that in the soil assimilable.

On new soils lime is certainly a great agent in producing fertility, but from the fact that the lime merely helps to use the plant-food in the soil, without bringing any to it, it is evident that, if used alone upon the soil, the latter must sometime become exhausted.

SILICIC ACID, IRON, MANGANESE, MAGNESIA, CHLORINE, AND SODA.

These substances, with a few others, though formed in plants in varied quantities, have not, so far as experiments have been made, proved of any value in manures. It is true some of these are indispensable to the plant, but they always exist in soils in sufficient quantity for vegetable growth. In regard to silica, it should be remarked that there have not been a sufficient number of experiments made with cereal plants to show whether or not it might be advantageously used as a manure. Mr. Lawes found no advantage from its use upon his farm at Rotamsted, in England. Common salt has for a long time been used by English farmers with benefit as a means of stiffening the straw of wheat and rye, and preventing the grain from falling before harvest. The testimony obtained from them by the author of this article in a two years' residence amongst them was not uniform in character, but very generally was in favor of the use of salt, and, more recently, some experiments with salt and discussions upon its use, by Liebig, (Letters on Modern Agriculture, 1859, p. 55,) have attracted an interest to the subject peculiar to everything that this great chemist does. We find that it operates as an indirect agent in rendering plant-food in the soil assimilable. Its use, therefore, like that of lime, will depend upon its cost as an indirect agent compared with the cost of the plant-food it prepares.

We have, therefore, found that of all the elements that constitute the food of plants, only three or four have an especial practical importance to farmers as a direct source of vegetable nutriment. In view of this, we might suppose that the science of manuring crops would embrace but few principles, and that these would involve but few rules in the art of manuring. But we have seen that the whole subject is complicated by the organic matter of soils and the physical and physiological conditions and indirect agents involved in the process of manuring crops. We shall proceed to see how far the principal experiments and facts we have considered lead us to practical results.

THE MEANS OF ASCERTAINING WHAT A GIVEN SOIL REQUIRES IN ORDER TO PRODUCE CERTAIN CROPS.

It was at one time thought that soil analysis would afford a potent means of answering this question, but the agricultural chemists of Germany, France, England, and America, have abandoned the idea. Extended investigations upon soils and manures, such as the able researches of Professor Way upon the absorption of soils, the interesting and important investigations of Professor Voelcker upon stable manures, the recent researches of Liebig upon common salt in agriculture, and the thorough and long-continued investigations of Lawes and Gilbert, are all of vast importance in leading us on, step by step, through the mysterious labyrinth of vegetable nutrition in soils. But these methods are applicable to the entire world rather than to the individual purposes of particular farmers, and they should be undertaken by government rather than left to individuals, whose means are inadequate to follow them out.

We must, therefore, resort to other means than soil analysis. The unproductive soil will want the employment of physical or chemical means, or both.

(*a.*) The physical agents involved in draining and irrigation are of limited application, and the necessity of draining bogs and marshes is so obvious, in view of the facts already presented, that we will assume that this has been done or is not required, and that the land still is unproductive, although subjected to thorough tillage.

(*b.*) The soil either does not contain the elements of plant nutriment in sufficient quantity, or they are not, if present, in a condition assimilable by the plant. If they are not present, they *must* be supplied. There can be no other alternative. If they are present, but not assimilable, the farmer must ascertain whether it is cheaper to supply the conditions requisite to make them assimilable, or to supply the required elements in an assimilable form. He must also know whether the conditions which make those in the soil unassimilable can operate to render those added unfit for vegetable nutrition.

In the present state of science, so far as we are able to solve these questions, it can only be done by a judicious system of experimentation with those substances which are direct and indirect sources of nutrient matter to plants. To solve the question in its most general form we must so arrange the relation of these substances to the crop during its growth, that we can tell the effect produced by each alone, and in every possible combination with all or any part of the other substances.

If we enter upon such a system of experimentation, without the aid of our previous considerations, the solution of the question would require such an extended system of experiments as would make it practically impossible to perform them. But agricultural science and practice have taught us that sterile soils are deficient in assimilable nitrogen, potash, phosphoric acid, or sulphuric acid, and we can therefore simplify the question by confining our attention to these.

For experimentation we shall therefore want—

1. Superphosphate of lime, or rather bones decomposed by sulphuric acid;
2. Gypsum, or plaster of Paris;
3. Some potash manures, or, for instance, good wood ashes with about ten to fifteen per cent. of potash;
4. Sulphate of ammonia or some other salt of ammonia.

Then select a field that will be a good representative of the entire farm, and in this lay off plats A, B, C, D, &c., across it.

On A sow 300 pounds of superphosphate of lime.

On B sow 200 pounds of gypsum.

On C sow 800 pounds of wood ashes, or 200 pounds of crude potash.
On D sow 200 pounds of sulphate of ammonia.
On E sow same as A and C both.
On F sow same as A and D both.
On G sow same as B and C both.
On H sow same as B and D both.
On I sow same as C and D both.
On J sow same as A, C, and D.
On K sow same as B, C, and D.
On L sow nothing at all.

Now lay off the same land in plots I, II, III, by line at right angles to the lines A, B, C, and on the new plots perform certain physical operations thus:

On I sow common salt, 200 pounds per acre.
On II spread caustic lime, 60 bushels per acre.
On III put an organic manure.
On IV nothing at all.

The result sought by such experiments are so obvious that they hardly need elucidation. Suppose the crop ready for examination: we go to plat IV on the side A, and cross over the successive plats A, B, C, &c., and study the effect of each manure alone and in combination. On A we have the result with superphosphate, but as all superphosphate contains gypsum, we must compare it with B to see whether the superphosphate is valuable. On C we have wood ashes which enable us to see the effects of potash, and thus we cross over and observe all the other plats.

The further experimentation would depend upon the result of this, and hence no general rule can be given for it, but it will be obvious to any one understanding the principle.

Let us suppose a case for an example. Suppose—

That A gives an increase over L;
That D gives an increase over increase over L;
That F gives over A or D;
That J gives equal to F;
That H gives equal to G;
That I gives equal to D;
That J gives equal to F;
That K gives equal to D.

It is quite evident that these results would point to phosphoric acid and nitrogen as two elements failing in the soil in an assimilable condition.

By crossing the plats I, II, III, we would learn whether the physical conditions and secondary agents here used tended to prepare any of the elements wanting for the plant. If we found that the salt or the lime seemed to perform the same office as the phosphate or ammonia salt, the result would be clear to us, and we would settle by simple calculation whether we should use the direct or the indirect agents. If the indirect agents gave no result, we would have to supply the direct agents. To follow up the subject, let us suppose such to be the case.

We may now make a number of experiments as to the form, the time, and the manner in which we should supply the failing elements.

We may make plats to compare the action of nitrogen in ammonia salts with that in soda and potash, saltpetre, or in rape cake, hair, wool, or any of the different sources of this element. We can also experiment with bone phosphate,

superphosphate, phosphatic marls, or whatever source of phosphate we may have at our disposal. These last experiments may be subjected to the different physical conditions of the first. They will not only enable us to confirm the first, but will extend our knowledge of the whole subject. When we shall have come to definite results as to the value of these several sources of nitrogen and phosphoric acid for our land, we can make still another series as to the time to put on the manures wanted by the land, the depth to which they should be put, &c., &c.

And when we shall have thus learned what elements are wanted, and how to apply them, we can embody the method in a few simple rules to be followed by the most ignorant or illiterate laborer who has no other interest in his labor than the daily wages it brings him.

Extended experiments, similar to the above, once carried out for a few years at the expense of government, upon a large scale, would admit of a generalization of facts in such manner as to simplify the experiments requisite for local districts; and the thus simplified experiments, carried out in local districts, would so far simplify the experimentation of each farmer as to make it practicable, with very few experiments, to learn just what elements his land wants.

Knowing this, he goes into the markets, not looking after the recommendation of this or that farmer who used a bag full of this manure or a barrel full of the other with good result, but he goes intelligently asking for the cheapest source of assimilable nitrogen, or soluble phosphoric acid, or for whatever element or elements his land requires. And he buys the manure on the assumption that it contains a certain amount of the element he wants. Suppose he wants nitrogen, and has been told that he should not pay more than 16 cents per pound for it. He buys guano containing 10 per cent. nitrogen for $1 60 per hundred. Suppose it costs 40 cents per hundred to haul it home, we have—

Nitrogen, 16 × 10 =	$1 60
Hauling 100 pounds	40
Total cost	2 00

Or 20 cents per pound.

Or suppose he can purchase sulphate of ammonia at $3 per 100 pounds, and that it contains 20 per cent. nitrogen. Then we have—

Cost of 20 pounds nitrogen	$3 00
Cost of hauling 100 pounds	40
Total for 20 pounds	3 40

Cost per pound, 17 cents.

The cost of hauling must always be added, and the less the per cent. nitrogen in a given substance the less is that nitrogen worth per pound, because of the cost of hauling it, providing the other material is valueless.

When correct ideas in regard to manures shall have become general, manufacturers will only sell, and farmers will only buy, manures according to chemical analysis, and until this is done the farmer will never be safe in purchasing them.

The following figures will give a general idea of the value of several sources of nutrient elements for plants:

Nitrogen manures.

Sulphate of ammonia	18 to 20 per cent.	nitrogen.
Soda saltpetre	14 to 16 "	"
Dry blood	10 to 12 "	"
Horns of cattle	9 to 11 "	"
Leather	6 to 7 "	"
Hair from tanners	5 to 8 "	"
Wool offal	4 to 6 "	"

Nitrogenous and phosphate manures.

	Nitrogen.	Bone phosphate.
Peruvian guano	12 to 15 per cent.	20 to 28 per cent.
Fish guano	7 to 8 "	28 to 33 "
Bone dust (fresh bones)	4 to 4½ "	45 to 50 "
Bones (after loss of glue)	2 "	50 to 60 "

Professor Johnson, in his able report on manures to the Connecticut State Agricultural Society, following the example of Professor Way, Stockhardt, and others, fixed the following prices upon nutrient elements:

Nitrogen, per pound	17 cents.
Soluble phosphoric acid, per pound	12½ cents.
Insoluble phosphoric acid, per pound	4½ cents.
Potash, per pound	4 cents.

These numbers will give a general idea of the value of manures if we but have the analysis of them.

Thus a manure which, in 100 pounds, would contain of—

Nitrogen	2 pounds, would be worth	17 × 2 = 34 cts.
Soluble phosphoric acid	4 pounds, would be worth	12½ × 4 = 50 cts.
Insoluble phosphoric acid	10 pounds, would be worth	4½ × 10 = 45 cts.
Potash	8 pounds, would be worth	4 × 8 = 32 cts.
Sand	76 pounds, would be worth	0 × 76 = 00 cts.
	100 pounds, would be worth	$1 61

Again, we would say that whatever price is fixed to the nutrient elements, manures should be sold according to analysis at this price.

In the absence of analysis it is better to purchase from responsible houses, of known reputation for honesty, than to deal with transient traders in manures, but even this honesty is not a sufficient guarantee for the farmer.

We would not think of buying an indefinite mixture of wheat and chaff by the bushel from even an honest man, even though other honest men had tried a "bag of the mixture," and found it made good bread when cleaned. Now, nine-tenths of the manures offered for sale are just like this mixture of wheat and chaff, and nothing but chemical analysis will supply, as regards the manure, a test analogous to that of the winnowing mill for the wheat.

In order to show the necessity for a better-regulated system in the sale of manures, we present the following analysis, made by Messrs. Holliday and McCormick, in the Pennsylvania Agricultural College laboratory, under the superintendence of the writer of this article.—(Abstract from Dissertation for Promotion to the Degree of Bachelor of Scientific and Practical Agriculture. By Messrs. Holliday and McCormick: 1861.)

Analysis.

	Volatile matter.	Nitrogen.	Anhydrous phosphoric acid.			Price sold at per ton.
			Soluble in water.	Insoluble in water.	Total.	
Lawes's superphosphate	30.78	(?)	14.77	4.48	19.25	$34 00
Rhodes's superphosphate	46.18	(?)	11.11	4.02	15.13	45 00
Berger & Butts's superphosphate	19.75	0 00	4.13	10.58	14.71	.....
Mapes's nitrogenized phosphate	25.31	1.35	0.11	9.10	9.21	55 00
Bough & Sons' raw bone phosphate	33.65	3.17	0.05	10.52	10.57	.....
Tasker & Clark's phosphatic fertilizer	40.13	2.76	1.76	11.52	13.28	.....
Tasker & Clark's meat and bone compost	47.49	1.23	0.00	9.43	9.43	.....
Bough & Sons' ground raw bones	40.55	4.49	0.00	23.14	23.14	.....
Rogers & Gect's ammonia superphosphate	94.71	18.96	0.00	0.00	0.00	.....
Pacific ocean guano	23.31	8.75	.....	9.26	9.26	.....
Government Peruvian guano	43.73	7.50	.....	12.98	12.98	.....
Peruvian guano	64.25	14.98	.....	13.16	13.16	.....
New fertilizer	17.20	0.00	0.00	2.43	2.43	.....
Marl	9.92	0.00	0.00	1.03	1.03	.....
Lawes's sulphate of ammonia	99.12	20.30	0.00	0.00	0.00	.....
Lodi poudrette	41.59	1.38	.....	6.80	6.80	.....

We shall leave the reader to criticise these according to the rules we have established, when he will see the danger of trusting to a name, or of purchasing without analysis.

We will leave the subject with the single remark that plant-food in some of these manures will cost the farmer twice as much as in others; and when farmers become sufficiently educated in the principles of agricultural science, some of these articles will be driven entirely from the market, and the manufacturers of others, by receiving the patronage now indiscriminately bestowed upon good and bad manures, will be able to produce better and cheaper manures than the best of the American specimens given above.

In conclusion, we would remark that there is very much yet to be learned in the art and science of manuring crops. It is a subject, more than any other scientific question, which deserves the attention of a great agricultural country like our own. All the difficulties which it involves, and which meet us at every step in its consideration, are legitimate subjects for scientific research, and they can only be settled by this means.

At the present time a vast number of scientific men in Germany, France, and England are laboring to solve the questions suggested by agricultural practice, but such is the expense and time involved in these investigations, that they are not making such progress as the importance of the question demands.

Another difficulty in the way of the consideration of scientific agricultural questions is the general ignorance of farmers of the scientific principles involved in agricultural practice—an ignorance which results in great part from the want of agricultural institutions of learning where they may be taught. In this regard, the veto of the agricultural college bill by the late President was to be deemed unfortunate; but the solid hope remains that this error, as well as more conspicuous errors of his administration, will be forgotten in the wiser action and happier fortunes of the future.

ENTOMOLOGY

AND ITS RELATIONS TO THE VEGETABLE PRODUCTIONS OF THE SOIL, WITH REFERENCE TO BOTH DESTRUCTIVE AND BENEFICIAL INSECTS.

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THE history of the habits, transformations, and physical structure of insects is a subject that cannot now be entirely disregarded by the intelligent farmer, gardener, or fruit grower, if he desires success and eminence in the pursuit of his calling. It is not only necessary that he should know what are destructive insects, and the seasons, the manner, and the means they employ in effecting their work, in order that he may circumvent them; but he should also acquaint himself with those that, from the peculiarity of their habits, are esteemed "our insect friends," and also the seasons, places, and circumstances under which they befriend man, that he may become a co-worker with them in carrying out the desirable end.

Probably no *class* of men are more favorably situated, in many respects, than the above-named class of people for carrying on observations and making discoveries in this particular branch of natural science, because none others, in the pursuit of their usual occupations, come more frequently into contact with the insect world, or are more sensibly affected by its benefits or its injuries to the labors of their hands. A careful and familiar acquaintance with insect *forms*, and with the peculiar seasons and circumstances under which they may be found in their various stages of development, will enable the husbandman to recognize them from habit, that he may destroy the one class and spare the other as often as he encounters them in his daily walks of life. In carrying out this acquired experience, he may not be merely demolishing or fostering the single individual of the great insect family which he may at any one time encounter, but, on the other hand, hundreds or thousands yet in embryo may be involved as to their fate in every successful adventure, just according to the prolification of the species or to the favorable or unfavorable period in its transformations, whether *before* or *after* sexual impregnation or oviposition.

Nearly all the plans and remedies of general application for the destruction of insects that have yet been discovered are more or less defective, because sufficient attention has not been paid to that discrimination so essential in distinguishing between friends and foes when they have been encountered as *larvæ*, as *pupa*, or as *imago*, or perfectly formed. This is the more to be regarded, because nearly all remedies of merely human invention are deficient in their *elementary* principles, or impracticable in their application; whereas the instincts of *carnivorous* or parasitic insects are most perfect and constant, and if undisturbed by incidental interventions they rarely or never fail in accomplishing their purposes. The habit of one insect to prey upon another is a pre-existent end of its sensuous being which it cannot possibly resist; whereas men in their destructions of insects are constantly influenced by various motives, such as interest, comfort, caprice, or revenge, and only continue their operations as long as those motives operate.

It may be necessary to say here that the term insect is now restricted by scientific men to the *hexapods:* namely, those six-footed denizens of the animal world that are known under the common names of *beetles, bugs, bees, grasshoppers, flies, &c., &c.*, and that they are primarily produced from eggs, whatever secondary modes may obtain among a few of them, and that the egg state and their distribution and disposition constitutes one of the most important epochs

of insect life, because on this depends all the subsequent states and conditions affecting its development or decay. So faithful and constant to the instincts of her nature is the female parent insect, that when not thwarted in her purposes she always seeks the time and place for the deposition of her eggs most favorable to the development of her young when they are excluded therefrom.

After a longer or shorter period in the egg state the young insects are brought forth in the infantile or *larvæ* state, and are commonly known under the names of *caterpillar, cut-worm, grub-worm, canker-worm, army-worm, wire-worm, skipper, maggot, &c., &c.*

This state is, however, lengthened or shortened, according to the season of the year, or to the degree of light and heat that are brought to bear upon it. Eggs that would hatch, under ordinary circumstances, during the months of June, July, or August, would, if deposited in the months of September and October, remain until the warm sun of the following spring could act upon them before hatching would take place, or until the natural food of the young had been provided from the vernal stores of nature. This fact is a common experience to silk-growers who retard the hatching of the *silk-worm* eggs, by keeping them in a place where the temperature is below the incubating point. Almost immediately after exclusion from the egg the young insect in its larval form commences devouring its natural food, and it is while in this form that the greatest amount of injury is done to the various species of vegetation, or whatever other substance it may feed on. In this state, too, it requires the greatest amount of daily aliment, for it is during this period of its existence that the most rapid development of all its subsequent energies, beauties, and instinctive faculties takes place. Access to the operations and development of all insects (if possible) is not easily obtained, and hence the difficulty of identifying the adult insect with the young grub or worm, in a vast number of instances. Even those that feed in open day, under our immediate supervision, upon the foliage, flowers, and fruit of the different kinds of vegetation, cannot always be readily identified. Habitual attention, however, to the *forms* of both the *imago* and *larvæ* of insects will enable the husbandman to determine whether they are friends or enemies, even if he should not know their particular species, nor yet have detected them in inflicting specific injuries. This knowledge will eventually come through habits of observation, just as an experienced fruit-grower may form a tolerable correct estimate of the shape and quality of the fruit a particular tree will bear from the external form and texture of its leaves, bark, and branches, although he may not be able to determine its particular variety.

After the larvæ or grub state is matured—which requires in a very large number of species from two to three weeks, and in others that many months or years—the *pupa* or quiescent state takes place, during which time the insects belonging to some of the natural *orders* take no food at all, and are altogether destitute of the powers of locomotion, whilst others are as active and as voracious during this period as they are at any other time, with increased facilities of locomotion. These distinctions can only be pointed out in special illustrations of the different natural orders to which they belong, and therefore can only be incidentally alluded to in these general remarks. It may, however, be of sufficient importance to remark that among *coleopterous* insects the longer or more protracted the larval period, the less numerous the species are.

The pupa state continues from five to ten or twelve days, and in some cases, or under some circumstances, to that many months. The continuance of the pupa state in general among insects is greatly controlled by surrounding circumstances, which, in most cases, may be readily understood, but in other cases of not rare occurrence they are seemingly inexplicable upon tangible grounds. If the change to a *pupa* takes place late in the summer or towards autumn the insects will remain in that state until the following spring; whereas if the same species had passed to a pupa in the beginning of, or at, mid-summer it would

have come forth a perfect insect after a few days. On one occasion I confined in a box half a dozen of the larvæ of our common black butterfly, (*Papilio asterias,*) which usually feeds upon parsley, fennel, and other umbelliferous plants, where I fed them until they were transformed into pupa. One evolved from the pupa state a perfect butterfly within ten days thereafter, although it was in the month of September; three remained pupa until the following month of May, and then came forth, whilst the fifth one was only aroused from its pupal sleep in the following month of August. From the sixth, through a disorderly by-way, came a species of parasitic hymenoptera, (*Trogus fulvus,*) a kind of wasp, in the beginning of the second season. It is difficult to understand all the circumstances governing such cases, or to determine their causes, and we are therefore left to infer that it is one of the prolific means in the wisdom of Deity that is employed for the purpose of providing against any natural contingencies that might occur interfering with a perpetuation of their species.

The *imago* or perfect state is the last one attained, for, with the exception of a little intensifying of texture and coloring, no insect arrives at any higher condition of organism and of beauty than it is a few hours after it has thrown off its pupal envelope; nor do any of them increase in size, except, perhaps, the abdominal proportions of the females before oviposition. This state, in a large majority of cases, is also the shortest and most harmless one; some entire *orders* that are very destructive as larvæ being now altogether changed in appearance and character. Many insects live in this state a very brief period, during which time they partake of no food whatever, and a large number of others live but sparingly upon the honey-dew of plants or the nectar of flowers. But it is during the perfect state that they are the most active in furnishing those colonies, or solitary individuals that afterwards become, in their grub or larvæ state, so exceedingly hurtful to the productions of the agriculturist, the fruit-grower, and timber-grower, as well as many other industrial interests. Drawn together by irresistible sexual instincts, the impregnated females become in some instances fearfully prolific, during which time also the noxious species are very destructive to the leaves of trees, the tender buds of spring and summer, the bloom, and often the substance of the fruits of summer. Although a large number of species only survive a few days, or at least a single season, yet there are numbers that live one or more years, hibernating during the coldest weather in winter, but reviving at the return of the warm spring or winter weather, becoming rigid again when cold ensues. These may often be found hidden under the bark of decayed trees, or in their burrows in the solid wood of it, or under stones, timbers, and rubbish, or in any other convenient hiding-place.

To point out some of the distinguishing features that are most prominently displayed in the history of a very limited number of a single *order* will mainly constitute the subject of these remarks. The original design had been to include familiar examples of the whole class *insecta*, but this was found impracticable, as it would have occupied more space than could consistently have been claimed for the subject in this place, and perhaps might have discouraged the majority of those whom it was intended to benefit. It seemed, however, necessary that some general remarks should have been made as a proper introduction to specific details, and in these an attempt will be made to exhibit the very striking similarity in the general *form* of the larvæ, that exists in those families or subdivisions that are of similar habits.

It is not necessary, nor is this the proper place, to enter into a lengthy disquisition on the anatomy and peculiar physiology of the insect world, because this is not what the farmers and fruit-growers of our country require. What appears most to be needed is a familiarity with the *tout ensemble* of the insect in its various stages of development, its economy, and habits of life, and whether they are to be regarded as enemies or as friends.

For efficient remedies against the encroachments and ravages of insects, those

interested must mainly rely upon their own efforts and discoveries, and the suggestions which they may from time to time receive from their friends, co-laborers, and neighbors, or from the public prints. A practical knowledge of these is more attainable from such sources than from an entomologist who has not the advantages that the husbandman has in the direction of making the necessary observations, and in a practical application of the remedies that may be known; or who may feel more interested in the anatomical structure of insects, their scientific classification, and their geographical distribution, than in finding out means for their destruction.

Under any circumstances, it is better to have as good an understanding as possible of insect economics, in order that all the auxiliary aid they are capable of affording may be taken advantage of in maintaining a safe equilibrium in the general plan of nature. Remedies, however, whether new or old, will be occasionally or incidentally suggested without pretending that they are entirely efficacious, or can possibly make any approach to the natural remedies already existing, and the prior existence of which have been coequal with insect life itself.

The order *Coleopteræ* is by many entomologists regarded as the typical division of the class *insecta*. The insects of this *order* in their mature state are solid in their structure, distinct in their articulations, and are covered with a horny or leathery external integument.

CARABIDÆ.—CARNIVOROUS OR PREDACEOUS INSECTS.

In order to facilitate the study of entomology naturalist have classified insects into *orders*, *sections*, *families*, *groups*, *tribes*, *genera*, and *species*, with other divisions of greater or less importance in a scientific sense, but not necessary to refer to here. Only a few common species in some of the most prominent families or other divisions can be illustrated, and in a general manner described, in an article that must necessarily be as limited as the present one, and those few will be confined to the order *Coleopteræ*.

The order *Coleopteræ*, as before stated, constitutes the *generally* acknowledged head or apex of the entomological column, including those insects which have received the common appellation of "beetle" among the English, and "käfer" among the Germans, although a few of them have, through custom, received the common names of "flies," as the "*Spanish fly*," the "*turnip fly*," &c. The object in view is to impress upon the minds of a large and highly useful class of men in our country, whose industrial productions constitute the chief staff of human life and health, and thus conduces to human happiness and wealth, a familiarity with insect *forms* in their different phases of development. We refer, in general, to all men who are engaged in productive labor, but in a special sense to those whose occupation is the tilling of the soil, whether as grain-growers, fruit-growers, or as gardeners, because the productions of these classes of men are, and have been, more injured from the depredations of insects than any others. And especially do we desire to point out to them some of the prominent points in the history, the habits, and the forms of some of their insect friends as well as their enemies, both in their larvæ and their perfect states, in order that they may cultivate closer habits of observation, and learn to distinguish between them, and thus guard against the pernicious tendencies of the one, and foster the presence and the good offices of the other.

At the head of the *order Coleopteræ*, or the beetle tribe, stands a large group of insects that, by common consent and common experience both in Europe and in America, are designated as being carnivorous in their habits, a large number of which feed only upon living prey. They may be said to occupy among insects the position that the hyenas and the tigers do among quadrupeds of the carnivorous kinds, some feeding upon any dead and decomposing animal matter, whilst others lie in wait and sieze their prey alive and then devour it. In addi-

tion to the peculiarities of form and structure in these insects, the terrestrial kinds may be known by the facility and the swiftness in their ambulatorial or running powers, and the aquatic kinds from the superior facility they exhibit in gliding over the surface of the water and diving beneath it. Many of these insects bear a strong general resemblance in their *forms* to other insects that are entirely different in their habits, and therefore it would be difficult to point out to the unscientific reader any certain manner of *immediately* distinguishing between them. Observation and reflection may, however, assist in ultimately making some approximation to a knowledge of their respective peculiarities and habits. Throughout the whole section of *Carabidæ*, or predaceous beetles, there is one tolerable certain mark by which they may be distinguished from all others, and that mark is observable from the very smallest species to the largest. If we turn the lower side of one of these insects upwards we will find, at the articulation of the hinder pair of legs with the body, a pair of flaxseed-shaped lobes, called the *trochanters*, united by one end to the *coxæ*, an anatomical process to which the legs are attached. These lobes are flattened and lie upon the abdomen parallel with the *femora* or thighs of the insect. Again, the nature of the food they feed upon implies the necessity of a swiftness of foot or of flight requisite to the work of capturing their prey. Vegetable-eating insects do not require this peculiarity of organization, therefore they are usually slow and hobbling in their walking and sluggish in their flight. When the fore legs of insects are disproportionately large, and armed internally with spines or teeth, the inference is that they are carnivorous, and that this raptorial development is intended to assist them in capturing their prey, although they may be neither swift runners nor fliers. But the larvæ of these carnivorous beetles are as distinguishable from the larvæ of the noxious or vegetable-eating kinds as the mature insects are. These, as well as the imago or perfect insects, are usually found under the ground, or hidden under stones, loose bark of old trees, wood-piles, or any other dark, out-of-the-way place, during the day, coming abroad only during the night or in cloudy weather. A few of them delight in the hot sunshine and the light, and consequently they may be seen indulging their carnivorous propensities during the brightest and warmest part of the day, to the dismay of any soft-bodied insect intruder that may incidentally come under their observation. These larvæ are also for the most part formed for running, or are endowed with sufficient strategic powers to supply any deficiency there may be in the former. Most of them are partly or wholly blackish above and a dirty white beneath, with the abdominal segments lapping over each other like the courses of a shingle roof, except when their bodies are much distended by being gorged with food, when a fleshy band will be between each of them. These segments are sometimes leathery and dull or shining through the entire length of the larva, and at other times, or in other species, only the three or four anterior ones, including the head, are of this character. Some of the mature insects are wingless, and in some of those the wing covers are united into one shield-like piece.

Prominent among these carnivorous Coleoptera are the CICINDELIADÆ, or "tiger beetles," nearly a hundred species of which have been named and described as being indigenous to the territory of the United States. Figure 1 is a very common species in the latitude of southern Pennsylvania. It is the *Cicindela vulgaris* of Say, and has probably an extensive range of country as its habitat, as I have found it in collections sent to me from various parts of the country. The bodies of these insects, as well as of all that belong to the order Coleoptera, are very apparently divisible into three distinct parts, namely, the *head*, the *thorax*, and the *abdomen*. To the head is attached a pair of *mandibles*, or jaws, of more or less prominence; a pair of *antennæ*, or feelers—

Figure 1.

also called horns—besides other minor and less visible organs; and also a pair of complex eyes of various forms, according to the family or tribe to which the individual may belong. To the thorax or chest is attached the front pair of legs; and to the abdomen is attached the middle pair and the hind pair of legs, the wing covers or elytra, and a pair of membranous wings that fold up laterally and transversely and lie concealed beneath the wing covers until the insect has occasion to use them.

The *tiger beetles* have the antennæ *filiform*, or thread-like; the legs long and slender, formed for running; the jaws prominent and sickle-shaped; the upper lip, or *labrum*, in many of the species is white; and a large number of them are all over—especially the under side of the body and the legs—of a bronzed or metallic lustre of various shades. The upper or dorsal view of the various species presents a combination of coloring, including blue, green, yellow, red, purple, white, brassy, coppery, and brown and black, diversified with punctures, spots, and a variety of irregular markings. Some species are local along the coasts of bays and seas, as the *Cicindela dorsalis* of Say—a whitish insect, bronzed beneath—and others have been found in almost all of our States and Territories, especially the *Cicindela sexguttata* of Fabricius, a beautiful green species, with three white spots on each wing cover.

The insect which we have figured as a representative of this family is about half an inch in length, and of a dark dull brown color, with whitish oblique and geniculated markings on the wing covers, and also a margin of the same color near their apex. They are partial to dry, sandy plains or paths, and are busily engaged, as are all their congeners, during the day in capturing and devouring other insects. They are so quick upon their feet and upon the wing that nothing can elude them, and also, from the same cause, it is difficult for man to approach near enough to entrap them. Their habit is to suddenly start up and then to alight a few yards in advance, immediately facing the approaching object, and then darting off again when it approaches too near. *Cicindela punctulata*, Olivier, a smaller and more slender species, of the same dull color, but with rows of fine greenish punctures on the wing covers, is very common in our gardens in Lancaster county, Pennsylvania, and performs good service in destroying many of the noxious species of insects that visit there.

Fig. 2.

Figure 2 is a representation of the larva of *Cicindela*, a whitish fleshy grub, from half an inch to an inch in length, differing in its form from any other carnivorous larva, with a very large head, and a large and dilated anterior segmental development. Upon the back of the eighth segment there is a hump or tubercle, having two small spines or hooks pointing forward. The jaws are robust and strong, showing rather a flesh-tearing capacity than that of gnawing or cutting. The feet are rather short, and therefore the insect in this state of its development is but indifferently provided with running powers. It resorts, therefore, to stratagem, digging a cylindrical burrow into the earth by the aid of its jaws, in which it hides itself and watches for its prey. These burrows are perpendicular, and when the larvæ occupy them the large head and jaws are near the surface of the earth, and when a hapless intruder comes within their reach it is caught and drawn down to the lower end, where it is devoured at its leisure. Many root-eating larvæ of other families of insects are destroyed by the larvæ of the Cicindelans, especially those of the *Melolonthans*, a family of cockchafers, or "June-bugs," destructive to roots in the larva state and to fruit and foliage in the perfect state. These insects have very appropriately received the common name of *tiger beetles*, from their destructive and tiger-like dispositions, for when confined with other insects they immediately commence mutilating and dismembering them, after which they attack each other, leaving the stronger and more powerful masters of the field.

Fig. 3.

Figure 3 is a representative of the great family *Carabidæ*, or ground beetles, that rather shun than seek the light of day, going forth at night or in the evening or on cloudy days, when also many other destructive insects go abroad on their evil missions to the vegetable world. This is the *Galerita Americana* of Fabricius, a very beautiful insect, and one easily recognized by any amateur in entomology. It is about one inch in length, and neatly formed, being organized for a rapid pedestrian movement, which makes it somewhat difficult to capture; its organs of flight being also well developed, but it very seldom makes use of them when pursued. The head and the under body are black, and the thorax, the feet, and the antennæ are a light or reddish brown. The wing covers are black and velvety, with a superficial tinge of blue. They hide themselves under stones, loose bark of stumps, or any other convenient place during the day, and sally forth on foot or upon the wing at night in pursuit of prey. Figure 4 is a coleopterous larva found among a number of the Galeritans, and, from the fact of its having been frequently found under similar circumstances, there does not seem to be much doubt of its being the larva of one of the species of Galerita. The color is a dull black and the head and the feet are of a yellowish brown, and its ambulatorial powers are very perfect. It may be the larva of a species of *Brachynus*, a genus of insects nearly allied to *Galerita* in habits and closely resembling them in form. There are more than one hundred and fifty species of these carabidanous insects that are classified between the genus Galerita and that of the species which I shall next name, and which is one of the types of the family to which they belong.

Fig. 4.

Figure 5 is *Calosoma calidum* of Fabricius, a very conspicuous and tolerably common insect in this latitude, southern Pennsylvania. This insect is about an

Fig. 5.

Fig. 6.

inch in length, and about half an inch in breadth across the widest part of the wing covers. The color is a dull black above and a shining black beneath, with also black legs and antennæ. On each of the wing covers are three rows of bright coppery or brassy spots, upon a ground of numerous longitudinal punctured striations. Figure 6 is the larva, a scaly or mail-clad grub, formed for walking or running, and when fully developed is more than an inch and a half in length. The color is a swarthy black above, and beneath a dirty or yellowish white. When the body is distended—which is nearly always the case—the fleshy portion extends beyond the dorsal scales, and also is seen between them. Down the middle of the back is a light streak and two lateral

rows of spots, but these are not present in all the species, nor yet in all the stages of larval development in the same species. This insect, both in its larva and its perfect state, is a great enemy to the larva of butterflies and moths, and is known to have ascended trees in pursuit of those noxious gregarious species of *lepidopterous* larvæ that defoliate fruit and ornamental trees. There are about twenty species belonging to the genus Calosoma, among which is the beautiful *Calosoma scrutator* of Fabricius, a rarer species than the former, having metallic green wing covers and a dark blue thorax, the whole margined with a bright coppery red, and bronzed or coppery beneath. *C. Wilcoxii* of Lec. is similar in color, but much less in size.

Figure 7 is *Carabus ligatus*, (Germ.,) a dull, black, ground beetle, about three-quarters of an inch in length, and about one-quarter of an inch broad at the widest part, across the wing covers. The thorax in this genus is longer than it is broad, whereas in *Calosoma* it is broader than it is long. In pedal members both genera are similarly organized, both being the same in habits. The wing covers of this species are marked with raised longitudinal lines, some of which are alternately broken, resembling a series of telegraphic characters. Figure 8 is the larvæ of this insect, a mail-clad grub; black above and whitish beneath, with two short spines projecting from the caudal segment. The head, as in all these species, is provided with stout, short jaws, in accordance with its carniverous character. There are about thirty species of this and the allied genera of *Scaphinotus* and *Sphæroderus* that inhabit the United States. Their

Fig. 7.

Fig. 8.

Fig. 9.

habits are nearly identical with those of *Calosoma*. Many of the species are without wings, and, therefore, they depend upon a half dozen of very elegantly formed and nimble feet in assisting them to escape from an enemy, or in capturing an insect foe. These insects are so well known to the gardeners and fruit-growers of Europe, and their uses so unequivocally recognized, that they never fail, on all occasions, to favor the colonization of them upon their premises. They are esteemed particularly useful in cabbage patches in destroying the cabbage caterpillar, (*Pontia brassica.*)

Figure 9 is a representation of the numerous family *Harpalidæ*, of which one or two species are said to feed in the perfect state on young grain and grass seeds, and upon its roots in the larvæ state. This is said to be the case, by several distinguished naturalists, in the foreign species *Zubrus gibbous*, but our *Zubrus* has not been yet identified as a vegetable feeder, although this is supposed to be the character of *Harpalus herbivigus* of Say. The insect figured is *Pangus caliginosus*, (Fab.,) a shy, black insect, one inch in length, of a uniform intensely black color. The elytrous are longitudinally striated, and the thorax is smooth and polished. Found under stones, wood, or any other convenient hiding-place, often coming abroad in cloudy weather, but easily alarmed. It is the largest species among the Harpalians, of which there are about two hundred species,

included in twenty or thirty genera. The larvæ of these insects approximate in form to that of figure 8, but are more tapering, more fleshy, and whiter, only the anterior segments of many of them being covered on top with a hard or leathery integument. Not enough is positively known of these larvæ to identify them with the particular species.

Figure 10 is *Dicælus dilatatus*, (Say,) a black insect, with coarsely fluted wing covers, and about three quarters of an inch in length. The posterior margin of the thorax and the base of the wing covers unite squarely and evenly, the thorax being as wide as the abdomen, with no intermediate narrowing between them. Some of the species are rugose or roughly punctured, instead of striated;

Fig. 10.

Fig. 11.

and some are purple or bronzed in color. Their organization and their habits are similar to the foregoing, and they represent a large sub-family of the *Carabidæ*. About thirty species belong to the genus *Dicælus*, but there are about two hundred and fifty species intermediate between them and the end of the family, without including those already enumerated.

Figure 11. *Dytiscus faciaventrii*, (Say,) a large species of water-beetle, is the only one that can be here introduced to represent about two hundred and fifty species, embraced in the families *Dytiscidæ* and *Hydrophiladæ*. The insect figured is about an inch and a half long, nearly three-quarters of an inch broad at the widest part; of a glossy, olive green, or brown color, and a yellowish margin around the thorax, and along the sides of the wing covers. The legs are formed for swimming, the hinder ones being oar-shaped, and the anterior pair having a large and very prominent tarsal development in the males. Figure 12 is the larva, a scorpion-like grub, about two inches in length, a very dirty white in color, fleshy, and with two hairy or pectinated appendages attached to the terminal lobe or segment of the body. Both the larvæ and the perfect insect are very carnivorous in their habits, being known to sometimes depopulate fish ponds of the smaller fry. The mature insect sometimes takes its flight and wanders away from its native element, and if, perchance, it should light upon *terra firma*, it is easily captured, for, like a fish out of water, it is almost incapable of direct locomotion. The wing covers of the *females* are deeply fluted, or corrugated longitudinally from the base towards the middle, and they are destitute of the anterior tarsal development. On one occasion I kept a male specimen of these insects alive in an aquarium for more than four months, feeding him daily upon angle worms.

Fig. 12.

This must conclude my remarks upon this part of the subject under consideration for the present. The reader may encounter many hundreds of species of insects corresponding with these forms, or making a greater or less approach

towards them, the true character of which, he may, by a little observation, be soon able to determine. The amateur may not fail to observe that the analogy between carnivorous insects and carnivorous quadrupeds is very striking; the former being partial to the herb-eating insects, and the latter preferring herb-eating animals, in satisfying their respective gastronomical propensities.

Intermediate between the carnivorous *coleoptera*, that feed upon other insects, and the wood-boring or vegetable-eating tribes, are several large families that are commonly called "scavenger," or "carrion beetles," "burying beetles," "skin beetles," "bone beetles," &c., because they are chiefly found in decomposed animal matter, such as carrion, old peltry, bones, or in hams and flitches of bacon that are exposed or not well cured. They are not, however, the progenitors of those countless numbers of white, spindle-shaped, footless maggots, that are found in such substances as have been above named; these are the larvæ of various kinds of *flies*. The larvæ of these beetles have the usual number of feet that pertain to coleopterous larvæ, being six in number, and some of them, as their necessities require, are quick in their pedestrian movements. Although these insects are *also* carnivorous or flesh eating, yet they do not prey upon their kind, unless it be some of the smaller species that are found upon or in the dead carcases of other insects, or in the cabinets of collectors. The form of the mature insects and also that of the larvæ are but modifications of the forms of those described in our first tribe, and some of them are equally nimble on foot; and although many of them are capable of doing a great deal of harm, yet, on the whole, the largest species, and many of the smaller ones, are esteemed highly useful, for they greatly assist in the decomposition of putrid animal and oily vegetable matter, that might otherwise remain for a long time poisoning the atmosphere and rendering it extremely unhealthful. The antennæ or horns of these insects are not filiform or thread-like, as are those of the *Carabidæ*, but on the contrary, they are short and thickened or club-like at the end, and the *trochanters*, so distinctly visible and spindle shaped at the articulation of the posterior legs of the former, are in many of these quite small or obsolete, and in others tooth-shaped or spined. In addition to decaying *animal* matter, some of these insects I have found in abundance on putrid *vegetable* fungi, and some species also feed upon living snails.

Figure 13 is our most common burying beetle, (*Necrophorus tomentosus*, Web.,) although there are other larger and more finely colored species found in the same latitudes. This insect varies much in size, being found from a half to three-quarters of an inch in length, and some chance specimens even longer. The greatest breadth is from a quarter to three-eighths of an inch. The color

Fig. 13.

Fig. 14.

Fig. 15.

is a jet black, with two transverse irregular yellow or orange brands across the wing covers, the lateral margins of which are also yellow; the thorax is covered with short, silky, yellowish hairs, and so is also the space between the hinder and the middle pair of legs beneath; the antennæ are black and have a club at the end, the legs are black and the posterior pair have the femora or thighs much thickened. Figure 14 is the larva, a spindle-shaped fleshy grub, with rather short feet and a dorsal scale upon each of the segments; the mature larva attains to about an inch in length. Figure 15 is the pupa. Although I

have frequently seen these larvæ and partially examined them, yet their natural element is so disgusting, and their smell so nauseous, that I have not heretofore retained them, and therefore for these figures I am indebted to other sources for representative species. These insects bury small dead carcases, such as snakes, toads, rats, mice, &c., beneath the soil by making excavations under them, and in some instances they continue their operations until they have buried them eight or ten inches beneath the surface. Into these putrid carcases the females deposit their eggs, and the young grubs find in it their appropriate food. After the larva has matured its state it forms a cavity in the earth near the place it was reared, and there undergoes its last transformation, coming forth a perfect insect. I have found these bettles from early spring, during warm days, until late in autumn, and therefore I infer that they hibernate during the winter, or the last brood remains in its pupa sleep until spring.

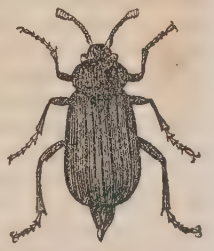

Fig. 16.

Figure 16 (*Necrodes surinamensis*, Fab.) is allied in form and habits to figure 13, except that it does not, so far as I know, bury the food of its young. I have found it most commonly on putrid fungi. Indeed, it is possible that these insects are only found under such circumstances, because the sanitary regulations of many communities prohibit the exposure of dead animal carcases. The color is uniformly black, with a transverse, zigzag, orange-colored band near the ends of the elytra, which are deeply ridged or corrugated longitudinally. The antennæ are not so clavate as they are in *Necrophorus*, and the abdomen does not extend so far beyond the wing-covers, or rather the wing-covers are not so abbreviated. Found also abundantly in carrion during the entire summer. The genus *Necrodus* is one of the intermediate links between *Necrophorus* and *Silphus*, which is the typical genus of the family SILPHIDÆ.

Fig. 17.

Figure 17, (*Silpha (Necrophila) americana*, Linn.,) the "American carrion beetle." This is the largest species known to the latitude of southern Pennsylvania, or perhaps to any of the States. It is not as abundant as some other species, but, like figure 16, it seems to be more constant and widely distributed. It is found in both carrion and fungi, and is esteemed a most useful insect for its labors as a scavenger. Figure 18 is the larva; a blackish and rather hard-skinned grub, with the anterior segments wide, and the body tapering gradually towards the end, which is terminated by two longer and one shorter points or spines. The feet are longer than in figure 14, and the walking capacities of the insect are also greater, indicating a greater dependence upon these pedal organs to shield it from danger, making it sometimes difficult to capture them when apprised of any approach. The length of the *imago* or perfect insect is about three-quarters of an inch, and the breadth about half an inch. The color of the antennæ, the legs, and the body beneath is black; the thorax is yellowish, with a dark centre; the wing-covers are of a brownish color and rough, which, on a closer examination, shows three pinnated lines rising from the base of the elytrons and reaching to the apex, which in some specimens is tipped with the color of the thorax; the head is sometimes drawn under the thorax, almost concealing it, and the caudal termination of the abdomen does not extend beyond the elytra.

Fig. 18.

Fig. 22.

Figure 22 (*Denuestes lardarius*, Linn.) is the "common skin-beetle," and is the only one of the family that can be here introduced, but, being the type, it may fairly represent a tolerable numerous tribe of insects that, under some circumstances, are very destructive to peltry, dried meats, horns and hoofs,

and sometimes even books. The name is derived from a Greek word signifying *skin*. This insect is either an importation from Europe, or our American species is identical with the foreign one, both agreeing in appearance, structure, and habits. Its length is one-quarter of an inch; the head and the thorax are black; the basal half of the wing-covers is an ash or drab color, with an irregular transverse row of small black spots; the apical half of the wing-covers is black; the feet are black and also the antennæ, which have a knob or club at the end. The mature insect endeavors to secure its escape from danger rather by stratagem than the use of its limbs, for that purpose mimicking death, at the least disturbance. They are the pests of the larder, the felter, and the dealers in peltry; but only when they are larva, and being once known, they can be provided against. Figure 23 is the larva, a bristly grub nearly half an inch in length, of which, when a boy, we have seen thousands beaten out of the peltry of the hatters. Figure 24 is the pupa, and frequently the whole three—larva, pupa, and imago—may be found in the same skins. There are some of the species that are said to devour the larvæ of lepidopterous insects, which is certainly a redeeming quality. Meats that are properly cured, canvassed, and whitewashed before they are put away, will be secured sufficiently against their depredations.

Fig. 23.

Fig. 24.

Both the perfect insects and the larvæ of a species of *Dermestes* have been taken dead from Egyptian mummies, that may have died three thousand years ago. This would seem to indicate that they had attacked the body before it had been embalmed, and that they had been killed in the process of embalming. Otherwise they could not have gained access to the body when that work had been completed. To preserve peltry well requires careful examinations frequently, and the skins smartly beaten up over a vessel of hot water or over a fire—the former is most preferable as the least liable to injure the skins. The amount of damage they are capable of doing to large fur establishments may be inferred from the fact that the furriers of London, some years ago, offered a reward of *twenty thousand pounds* for an available remedy against them, but it appears that none was found better than the one named, or similar means.

Fig. 19.

Figure 19 represents a large family of insects which have received the common name of "rove beetles," technically *Staphylinidæ*, from the typical genus *Staphylinus*. The insect represented here is *S. maculosus*, (Grv.,) of a reddish-brown color, and about an inch and a quarter in length. The feet are stout; the antennæ a little thickened towards the ends; the head large and the jaws strong; the wing-covers very short, but a pair of ample wings folded up beneath them, which the insect uses with the greatest facility, giving it a high degree of proficiency both in running and flying. This insect has the habit of elevating its long abdomen, throwing it forward something like a scorpion, and then, with distended jaws and defiant look and attitude, it presents a rather formidable appearance. The long, narrow, depressed form characterizes the whole family. They are very voracious, preying upon decaying animal and vegetable matter, the smaller species chiefly found in decayed fungi, manure piles, or under heaps of putrescent plants. Some species are also found in flowers, and a few are found parasitic in the nests of other insects. Figure 20 is the larva, which bears a general resemblance to the perfect insect, being found in similar situations and feeding upon the same substances. The head and anterior segments are large, the remainder of the body gradually tapering and ending with a sort of foot beneath, and two lateral hairy tails or seta.

Fig. 20.

Figure 21 is the pupa of an analogous foreign species, taken from Westwood, being merely to exhibit the peculiarities of the family. These insects cannot be classed along with our insect enemies, but, on the contrary, as a whole, they are useful friends, rarely attacking anything that is sound, but only that which is putrid, thus assisting its decay.

Figure 25 is *Clerus ichneumoneus* of Fabricius, a small and beautiful insect of three-eighths of an inch in length; head and thorax a bright brown, and the base of the elytrons of the same color; then follows a black transverse band across the wing-covers; then a broad, orange-colored one, terminating with a black one; the feet are black; the antennæ are of the same color and somewhat

Fig. 21.

Fig. 25.

Fig. 26.

Fig. 27.

clavate. Figure 26 is the larva, an active red, pink, or yellowish grub, that is often found under the bark of old trees and wood, where it is said to live upon other larvæ. In Europe there is a species that is parasitic in the nests of bees, and doubtless they may assist the bee moths in our own country in damaging the quality of our hives. Their operations in a bee-hive are different from the bee moth, which breaks down and devours the cells, constructing a gallery, as it goes, to protect it from the rancor of the bees; whereas *clerus* deposits its eggs in the cells, and the young grub, when hatched, destroys the bee grub, and passes from one cell to another. The larva is about half an inch in length when mature in this species. Figure 27 is the pupa. Although these insects are not vegetable feeders—unless we except the mature insect, which is partial to the honey or pollen of flowers—yet they can injure in other ways. The family of *Cleridæ* is small, and the species are generally small in size.

In the remainder of this article I shall introduce some families of very different habits, in order to show the great difference there is between the *forms* of the wood-boring and vegetable-eating larvæ and those that are predaceous or carnivorous in their habits, so that the most common observer may learn in a short time to what general division among the Coleoptera an insect may belong when he sees its larvæ, and also what kind of larvæ will spring from the eggs of a particular kind of insect. He may not be able to do this immediately, nor in *all* cases—for the name of insect species is not only "legion" but *legions* —but he will be able to do it in all the present examples and in a very large number of analogous ones. Never, until there is a carefully and completely illustrated work on American entomology, giving one or more typical species of the various *tribes* or *families* in accurate illustration, will the student of entomology be able to make much progress, unless he is in correspondence or on terms of social intercourse with some competent entomologist, or has access to a good cabinet. Attention cannot be paid strictly to scientific classification, because the examples illustrated are too few, and therefore reference could only be had to a few species that have been grouped together on account of a similarity of habits and structure. There are two or three hundred species of carnivorous insects that are similar in habit and in larval development to those that have just been noticed in connexion with the figures annexed.

LAMELLICORNIA.

The next division of our subject will be a brief notice of the old family LAMELLICORNIA, all of which are vegetable feeders, and nearly all of them very

destructive in one way or another. These insects in their larva state are found in wood, but the larger number by far burrow into the ground, and there feed upon the roots of grass, grain, and other species of vegetation. In this state they are most commonly known as the "*grub-worm*," and the accompanying figures represent the prevailing form. These grubs or larvæ, on a very little observation, will appear very distinguishable from the families of those noticed among the carnivora. Outside of their burrows they have very inferior powers of locomotion, and the organs by which the denizens of the animal world in general are enabled to move from one place to another, that is, their feet, seem to be of little use for that purpose to these, being weak and awkwardly used, and not at all in locomotion, as the animals move along on their sides by the aid of the expansion and contraction of the segmental sections of their bodies. In this group they are nearly always found lying upon their sides, and bent *a la crescent*. Some of these larvæ remain in that state for periods of from three to five years, and others but a single year; those burrowing into wood requiring a longer period to complete their larval development than those living in the ground. The perfect insects, for the most part, partake of very little food, and that the pollen or honey of flowers or the juice of fruits, whilst others are very destructive to both the flowers and the foliage of various kinds of vegetation, and a few have been known to seize the larva of other insects and suck out their juices. The larger number of them are distinguishable from the awkward manner in which they use their legs when they attempt to walk, but more particularly from the form of their antennæ, which, with a few exceptions, are terminated by a sort of club or tuft, which is laminated in tablets or plates, like the leaves of a book; hence the name *lamellicornia*. From the very small number represented, no attempt at regular classification can be made here, yet we may separate them sufficiently to represent the tribes or sub-families into which they are capable of being divided.

Fig. 28.

Fig. 28 *a*.

Figure 28, (*Lucanus dama*, Thunb.,) a smooth and glossy brown beetle, from one inch and a quarter to one inch and three-quarters in length, represents some eighteen or twenty American species of the wood-boring lamellicorn beetles. The antennæ of these insects are, however, not lamellated, strictly speaking, but are comb-shaped at the end, or toothed. The antennæ of figure 28 is elbow-shaped, the first joint being very long, and the rest of them very short, as seen at figure 28 *a*. The head and the thorax are very broad, in some species broader than the base of the wing covers; the legs are long and exceedingly awkwardly used, the insect sometimes propping up its head and thorax with the hinder part of the body down, with the large mandibles or jaws distended as if in an attitude of defence. They have ample wings and fly abroad at night during the

months of June and July, and many of them are found every morning drowned in ponds and cisterns. The mandibles of the female are stout and short, and are used to cut a hole into the bark of trees, into which she deposits her eggs. They feed upon the honey dew of the leaves, or upon the exuding sap of trees. Figure 29 is the larva, a fleshy, whitish grub, with a large rust-colored head, and strong jaws; six rather delicately formed feet attached to the three anterior segments of the body; the body is bent as represented, narrowing towards the end, the terminal segment being the largest; usually found in willow and oak trees, and, according to Rösel and others, it remains in the larva state five or

Fig. 29.

Fig. 30.

Fig. 31.

Fig. 31 *a*.

six years. Figure 30 is the pupa, which occupies a horizontal cavity in the body of the tree near the surface, enclosed in a sort of cocoon, formed out of gnawed wood glued together, something similar to that of the genus PRIONUS.

Figure 31 is our very common black wood-boring beetle, (*Passalus cornutus*, Fab., or "horned passalus.") This insect is about one inch and three-eighths in length, and of a uniform shining black color, with the wing-covers deeply lined or corrugated longitudinally. The mandibles are short and stout, and there is a short horn on the head bent forward. The legs are of moderate dimensions the front pair being the largest, and the antennæ are pectinated or subserrated at the ends, as seen at figure 31 *a*. Figure 32 is the larva, a large whitish fleshy grub, usually found abundantly in old and decaying oak wood, more particularly in black oak wood or in old stumps.

Fig. 32.

Fig. 32 *a*.

Fig. 32 *b*.

Figure 32 *a* is a dorsal, or back view of the same; and *b* is an illustration of an immature grub. Frequently the mature insect, the recently evolved insect, which is then a light brown in color, and different sizes of the larvæ, as well as the pupa, may be found in the same piece of wood, and in a short time, when

their numbers are large, they reduce the whole to a mere shell, the inside being penetrated with chambers, and the mass ready to fall to pieces by only ordinary handling. The mature insect bears some resemblance to a number of the predaceous species, but they may be readily distinguished from them by the shape of the antennæ; from their slow and sluggish manner of walking, the cornuted head, and from other distinctive marks, and especially by the brush of brown hair on the middle pair of legs.

Fig. 33.

Figure 33 is the common black "dor beetle," or, perhaps, more appropriately, "dung beetle," which is common in almost all the districts of our country. It is the *Copris carolina* of Linnæus, and is often known to spread terror among the household, by its entering through open windows in the warm evenings of June and July, flying about very sluggishly, and awkwardly striking with such force against the ceilings and side walls as to precipitate itself upon the floor. This insect is about one inch in length, and about five-eighths of an inch broad, the head having an obtuse wart or protuberance in the middle on top. The form is very convexed; the thorax is raised up abruptly in a transverse ridge, having one or two small tubercles or warts at each end, or upon each side, which is margined with lashes of brownish hair; the wing-covers are laterally grooved, and the grooves near the apex seem to be filled up with dirt. This insect, and the following species, represent a large number of excrementitious Lamellicornia, that are considered more useful than they are hurtful, inasmuch as they assist in the removal of animal excrements, which they feed upon, and bury a portion beneath the soil, into which they deposit their eggs, and upon which the young, at least in their earlier stages, feed. The larvæ, which is not figured here, is very similar to figure 36. Indeed, there is such a strong resemblance between the larvæ of nearly all the true Lamellicornia that, except in size, one figure might represent the larger number of them. Figures 28 to 32 may be said to represent the first division, or *Lucanidæ*, and figures 33 and 34 the second division, or *Scarabidæ*. The antennæ of the latter have the ends laminated, or terminating in a club of oval plates, lying together like a fan or the leaves of a book; hence they have, also, been called "book horn-beetles;" and the terminal or caudal segment of the larvæ is very large, with a proportionately large anal opening.

Fig. 34.

Figure 34 is the common dung-rolling beetle, commonly called the "tumble-dung," and is nearly the first insect that is recognized and identified in early boyhood. Both this insect and the immediately foregoing have a very wide range of country as their *habitat*. This is the *Cauthon lævis* of Drury, or the *volveus* of Fabricius. These insects make a ball of excrementitious matter, in which both male and female engage, and after rolling it to some distance away from the original depository, they bury it in the earth, and deposit one or more eggs into it, and soon after all their eggs are deposited they die. The reason for thus rolling the ball such a distance, and sometimes with the most persevering labor and under the greatest difficulties, must be very conjectural, probably to remove it, effectually, out of the way of *Copris carolina*, which burrows and deposits its ball immediately beneath or near the original depository. These insects do not seem to know their own balls, or whether the ball they are rolling is a proper one for the purpose intended or not, for I once saw a pair of them busily rolling a large unripe and undigested cherry that they appropriated from a deposit of human excrement, and they seemed to manifest as much anxiety for

its safety, and as much perseverance as if it had been of the usual substance and consistence. The antennæ of this species and the foregoing one are a modification of figure 35 *a*, and the larva resembles figure 36. Figure 35 is the "June bug" of the common people, but in the locality of Southern Pennsylvania "*May* bug" or "May beetle" would be more appropriate; for, when the season is not too much retarded by lingering winter, they come out of the ground in great numbers during that month. This insect, the *Phylophaga quercina* of Knoch, is the representative of twenty or thirty other species that belong to the same *genus*, and a large number of allied genera, all of which are very injurious in their larva state to the roots of grains, grasses, and various other species of vegetation.

Fig. 35.

The mature insect is about an inch in length, and of a chestnut brown color, though differing in shade, according to the age. The whole insect is rather smooth upon its external surface, but at the same time it is faintly punctured, and there are two or three elevated lines on each of the wing covers. The terminal knob of the antennæ consists of three plates or leaves, figure 35 *a*; and the breast is clothed with yellowish hairs or down. In the perfect state this insect feeds upon leaves of trees, and where they occur in great numbers they are not only an annoyance, but they are very injurious. Figure 36 is the larva, a large whitish grub, with a light brown head, and feet of the same color, and an inch or more in length, always found bent into a crescent, but can move along upright, although always found upon its side. All kinds of poultry, moles, skunks, and predaceous insects are partial to the larva, or the soft and juicy pupa, or to recently-evolved *imago* of this insect and its kindred species, and therefore hundreds, and perhaps thousands or tens of thousands of them are destroyed every year by these animals. The best method for their extermination when they attack the foliage of trees is to shake them down in a sheet every morning, and then throw them into boiling water, after which they may be fed to poultry or swine, which are exceedingly fond of them. These insects may represent a third division of the Lamellicornia, called the *Melolenthidæ*, the typical genus of which is *Melolentha*, of which we have but three restricted and not very common species.

Fig. 36.

Another sub-family of this group are called the *Cetoniadæ*, after the typical genus *Cetonia*, of which we have but seven or eight restricted species, although there are a large number of species that may be referred to the family group. These insects are here represented by figure 37, *Gymnetis nitida*, Linn., commonly called in this locality the "Goldsmith," and with which every boy in the community is very familiar. The perfect insect is almost an inch in length, and about half an inch broad across the base of the wing-covers, which is its widest part. Some specimens are much less than these dimensions, the insect varying greatly in size and color. All are of a polished bronze color beneath, and of a velvety green, or light metalic brown, or brown and green on top. The *clypeus*, or front of the head, is drawn out to an obtuse point and turned upward. The legs, as in the other species of Lamellicornia, are rather long, but the insect uses them very awkwardly in attempting to walk on a level surface; they are, however, most efficient instruments of prehension when the insect alights on the foliage of vege-

Fig. 37.

ation. Figure 38 is the larva, a whitish grub found abundantly in gardens, gradually thickening from the anterior to the posterior termination, and somewhat shorter in proportion to the thickness than most of the other larvæ of the same family. The mature insects appear some seasons in great numbers in the month of June and the early part of July, and sometimes are found in abundance on the young potato tops. In the larva state they feed upon the roots of vegetation, and, like those of similar habits before noticed, they are capable of doing much damage, Poultry are very fond of them, and consequently many of them are destroyed as they come out of the ground, or are ploughed up, and perish in many ways as larva or pupa.

Fig. 38.

No attempt is intended in this article at scientific classification, and therefore some insects are mentioned out of the order in which they occur in strictly scientific routine. I intend only to make a brief and imperfect attempt to show the similarity in form—both in the perfect insects and also in their larvæ—that exists between certain kinds of noxious insects and others of a mixed character, and also the difference between those and our insect friends. Therefore, in continuation, although to some extent out of place, I cannot close my remarks on the Lamellicornia without alluding to two small, widely-disseminated, and very destructive species, that are also tolerably familiar to every one who has even cultivated a single rose-bush. Figure 39 is *Anomala lucicola*, Fab., the "Anomalous grape-vine beetle," to distinguish it from the spotted beetle that destroys the leaves of the grape-vine, *(Pelidnota punctata,)* which has been figured and described in the Patent Office Report for 1854. This insect is only a quarter of an inch in length, and of a dull yellow color above and below. Figure 40 is

Fig. 39.

Fig. 40.

Fig. 41.

Fig. 42.

the larva, a small "grub-worm," about half an inch in length, of a whitish color, and a dull yellow head, being very similar in form to other larvæ of the same family. The mature insect has, to my knowledge, been destructive to the foliage and the young grape-vine, gnawing the leaves into holes, and otherwise destroying its energy and physical vitality.

Figures 41 and 42 are the common "Rose bug" or "Cherry bug," of which there is such an abundance in this latitude almost every season. This insect makes its appearance in the end of June and the beginning of July, and is cotemporary with figure 39, and is allied to it in history, habits, and scientific classification. The perfect insect—*Macrodactyla subspinosa* of Linn.—is about the same in length as the one immediately preceding it, although it is more slender in form; the color is a dull yellow and velvety above, and whitish and mealy below, and the legs are yellow and proportionately long. The females deposit their eggs in the ground in the month of July, immediately after which they perish; the males dying a short time after the impregnation of the females. The larvæ of both this and the former named insect feed upon the roots of vegetation, and undergo their tranformations in the ground. As a remedy against their too rapid increase it has been long since recommended that all fallow ground where they exist should be turned up with the plough during the autumn and winter, and the larvæ and pupæ of these and various kindred species exposed to the rigor of a freezing season, if they have not been previously devoured by birds.

Crows will scent a freshly-ploughed field in the months of November and December, or February and March, for many miles, and will daily visit such fields as long as they yield them any sustenance, returning to the hills and deep woods to roost every evening. When the weather permits winter ploughing along the valley of the Susquehannah, the crows may be seen lighting upon the ground, a safe distance from danger, throughout the day in countless numbers, and as soon as the lengthened shadows of evening approach they are off again to their perching places, a distance of twelve or fifteen miles in the unfrequented mountains. It would be almost impossible to invent or apply any remedy for the destruction of the noxious insects of this family of Coleoptera more effective than the one suggested. Of course, when the mature insect comes under our observation, upon our grape-vines or elsewhere, we should adopt the most available means to destroy them. What the fowls do not destroy should be shook or threshed off, or picked off with the hand, and scalded or burned; but the destruction of the grub must necessarily be left to the tender mercies of the birds and beasts, or to the freezing rigor of the northwest winds. About twenty-five species of *Anomala* and allied genera exist in the United States—all of which are very similar in their form, habits, and history, but no more of them can be introduced in the present article.

CURCULIONIDÆ.

Omitting many insects of a partial or a decidedly noxious character, in an article even of the desultory character of the present one, yet it would seem deficient in its greatest and most essential point if it were entirely silent upon a family of insects that has created such a wide-spread notoriety as has that which includes in its membership the redoubtable CURCULIO. The family *Curculionidæ* of authors includes those insects which Linnæus arranged in his genus *Curculio*, namely, the "snout-beetles" or "weevils." There is probably not a nut or a seed of any kind that has not some species of weevil that attacks it and feeds upon it. In addition to this some feed upon fruit in their larva state—such as apples, pears, peaches, plums, cherries, &c., and some upon the leaves and leaf-stems of vegetation, and some upon the hard wood, or under the bark of trees. The larvæ of all of them are footless, maggot-like grubs, or the feet are so small as to be only rudimental or scarcely visible. These larvæ are short and thick whitish grubs generally, with a small black or brown head, and are bent crescent-shaped; many of them leaving the substance upon which they have fed during their larval period, and undergoing their transformations in the ground. The remedies that have thus far obtained, or that have been recommended for their extermination, have been of little or no avail, and, but for the natural counteracting means existing, little could have been done to further so desirable an end. Only a few prominent species of the family or group can be here introduced, and those merely as examples, and some of them not of common occurence in all localities of our widely-extended country.

Fig. 43.

Figure 43 is the *Sphenophorus 13-punctatus* of Herbst, and represents a large number of this and several other genera, which includes our "grain-weevil" *(Sitophilus granarius)* and the southern "rice-weevil" *(S. oryzea)* of Linn. This insect is about a quarter of an inch in length, spindle-shaped; of a red color above, with four black spots on each wing-cover and five on the thorax; the head, snout, and antennæ, the legs, and underside of the insect, are all black. During the mature state this insect feeds upon the leaves of plants, perforating them and greatly injuring them, if not entirely destroying their vitality or their respirating functions. This insect is not yet known to be specially hurtful to domestic plants, being found in the greatest abundance upon the wild

cotton that grows along the banks of rivers and smaller streams, yet it has been found upon various kinds of plants and garden vegetables that have been cultivated in close proximity to the native haunts of the insect, and in which the *Asclepias* also spontaneously grew. It is here introduced because it belongs to the old genus *Calandra*, to which the various kinds of grain weevils belong, and on account of its size and color is more readily recognized. Its larval history is unknown to me, but it is supposed to undergo its transformations in the interior of plants below the surface of the earth.

Fig. 44.

Figure 44 is an illustration of *Rhyncophorus Zimmermanii*, Schönh, and is the largest species of "snout beetle," or weevil, that is indigenous to the United States. This insect, including the snout, is about one inch and a quarter in length, and about half an inch across the wing-covers at the widest part. The color varies, in some specimens being a jet black, and in others a chestnut brown, with two black spots on the thorax, and a number of smaller ones on the wing-covers. The thorax is smooth and seems to lap over the base of the wing-covers, which are longitudinally marked with parallel lines, and they do not quite reach to the end of the abdomen. The "palm weevil" of the West Indies, and Central and South America, is nearly allied to our insect, which probably approaches the former in its history and habits.

Fig. 45 *a*.

Fig. 45.

This insect is introduced here because of its large size; on that account being a fit representative of the tribe to which it belongs. The larvæ is also unknown to me, but no doubt its history is similar to that of the palm weevil (*Cælandra palmarium*) which feeds upon and bores into the heart of the cabbage-palm, and is esteemed a great edible delicacy among the inhabitants of San Domingo. It is confined principally to the southern States.

Figure 45 is a representation of the largest species of snout beetle we have in Pennsylvania, the rostrum being shorter and stouter than the two species previously noticed, and the antennæ are not elbow-shaped, as in the former. Figure 45 *a* is a side view of the head, showing the snout, the anterior leg, and the antennæ. It is the *Ithicerus curculionides* of Herbst, and is a grayish beetle of three-fourths of an inch in length, including the rostrum, and is variegated upon the thorax and the wing covers with irregular rows of black spots. It is exceedingly injurious, in some localities, to the tender buds of apple, pear, and cherry trees, in early spring time, eating them out and entirely destroying the vital energies of the trees. If a sheet is spread beneath the trees in the morning and the principal limbs jarred with a muffled billet of wood, the insects will fall down into it and may then be destroyed by burning or scalding, or any other convenient or appropriate means. The larva is a wood-borer, and doubtless breeds in the dead limbs of the trees upon which the mature insect is found eating the buds. Like a large number of the curculians, this insect hibernates during the winter, and goes abroad in the spring as soon as the buds and blossoms of trees put forth. Figure 46 is the "chestnut weevil," found abundantly upon chestnut and chincapin trees, about the time the burs break open and expose the fruit in early autumn. The thorax and the abdomen of this insect is nearly half an inch long, and the head and rostrum are of nearly the same length. The color is brown, and the thorax and wing covers are irregularly spotted with ashen or

Fig. 46 *b*.

Fig. 46.

white. Figure 46 *b* is a side view of the head and rostrum, exhibiting also the dilated femor of the anterior leg, and the geniculated antennæ. At the end of the rostrum or snout is a small but stout pair of mandibles by means of which the female perforates the young chestnuts, into which she deposits one or more eggs, which hatch in due time, and subsequently develop into a white footless maggot-like grub, familiar to all chestnut eaters. Except in cases where the fruit is removed, these grubs find their way into the ground and finish their changes there, coming forth the next season when the trees are in bloom, upon which the insects may be found in their mature state, feeding on the pollen of the chestnut and chincapin flowers, and disappear entirely a short time after they have deposited their egg. The snouts of these weevils, of which there are some ten or a dozen species, seem to be adapted to the length of the spines of the burs, those inhabiting the chestnut being longer than those of the chincapin. Figures 46 and 47, are the imago and larva of *Balaninus Sayii* of Schönh. Very abundant in Southern Pennsylvania and elsewhere.

Fig. 47.

Figures 48, 49, and 50 are the imago, larva, and pupa of *Hylobius pales* of Herbst. The beetle is of a deep chestnut brown in color, half an inch in length, and having the thorax and wing covers dotted with yellow or yellowish white. The thighs of all the legs are toothed on the lower side, and the snout and head are as long as the thorax. This is the common "pine weevil" of the north and the south, but more particularly of the south, where it has done immense injury to the pitch pine, especially in the vicinity of Charleston and Georgetown, according to the testimony of Wilson and others. It seems a little singular that pitch, or turpentine, which is so obnoxious to insects in general, should yet be no barrier against the encroachments of this and other allied species of the insect world; but so it is. The females deposit their eggs in clefts of the bark, or in holes, cut in for that purpose with their sharp jaws, placed at the end of the rostrum, and the young grubs—represented by figure 49—operate immediately under the bark, often stripping whole trees of their natural external covering, and exposing their naked trunks and branches to inevitable decay. After a short pupal period the mature insects are evolved in the months of May and June. This insect is by no means numerous yet in the eastern district of Pennsylvania, but it is very common along the coasts of Lake Superior, judging from the immense numbers of them that are sometimes found dead upon the beaches, that have been driven in by the waves of that inland sea. Woodpeckers are their natural enemies, and it was Wilson's observations upon a bird of this family that led him to notice the insect and its depredations in the south. Figure 48 *c* is a side view of the head, thorax, and anterior leg.

Fig. 48 *c*.

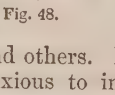
Fig. 48.

Fig. 49.

Fig. 50.

Figure 51 (*d* enlarged, *e* natural size) is the somewhat notorious "plum weevil;" also infesting the cherry, the apple, and other fruits. It is the *Conotrachelus nenuphar* of Herbst, but is most popularly known by the simple appellation of "curculio." This insect is scarcely a quarter of an inch in length, of a rough exterior, and colored in blotches of brown and grayish white. Two elevated warts or tubercles are about the middle of the wing covers, behind which are two larger blotches of white. Figure 52 is the larva, a white or reddish white maggot or grub, usually found in the various kinds of fruit during the months of May and June. The insects undergo their final transformations in the ground; but whether they certainly bring forth more than one brood during the season is not yet fully determined; or whether the last brood remains in the ground until the following spring, or comes forth and hibernates

Fig. 51 *d*.

Fig. 51 *e*.

Fig. 52.

during the winter, as many other insects do, seems to be involved in some doubt. Probably there is no other insect in the whole catalogue upon which so much has been written and talked about as the one under consideration, and yet it appears that no certain remedy has been discovered to prevent its destructive attacks upon the fruit, especially the plums of various kinds. As soon as the young plum has acquired sufficient pulp to nourish the young grub, the female "curculio" may be seen cutting crescent-shaped incisions into it and depositing therein an egg, and in this manner she will visit all the fruit until her stock of eggs is exhausted. When the tree and the fruit are of vigorous growth it often happens that the gum that exudes from the wound carries out the egg with it, and there becoming a hard globule, with the egg inside, the economy of the insect is entirely defeated, and the fruit escapes. If the trees are jarred in the cool mornings, before the insect has acquired its wonted activity, it falls to the ground and may be secured, or may become a prey to poultry. It has frequently been observed that plum or cherry trees standing in poultry yards, or with the branches hanging over water, or being paved underneath, have usually few or no curculios in the fruit. Fruit growers should make it a point to gather up all the green or immature fruit under their trees immediately after it falls, and thus prevent the young grubs from going into the ground to mature their state.

More than two hundred and twenty species of the various kinds of *curculio*, or "snout beetle," have been described and named as indigenous to the United States, many of them so nearly resembling each other in habits and form as to be scarcely distinguishable by any but a practiced naturalist, but all bearing so close a resemblance to the forms of those illustrated in these pages as to enable the amateur to distinguish them from other either destructive or beneficial tribes, and therefore he cannot go wrong in destroying all insects and grubs of the forms here illustrated, for their habits, although they may not be to the same extent destructive, yet the approximation is too close to allow their toleration.

SERRICORNIA.

Differing very materially, both in the perfect insect and in the larva, so far as their *forms* are concerned, from any of the insects heretofore described, is a family, or rather *two* families or groups, of wood-boring insects, that have been classified as the *Serricornias*, that is, having the antennæ or horns *serrated* or saw-toothed along the one edge. These two families are usually designated as the *Buprestidæ* and the *Elateridæ*, from the two typical genera *Buprestes* and *Elater*, but the common names that obtain for them in various districts and countries are "spring beetles," "click beetles," "hammer bugs," "wood choppers," "skip jacks," and "schnellkäfer" among the Germans; at least these names are applied to the *Elaterida*.

So far as the *Buprestidæ* are known as to their habits and history, they are all wood-borers during the period of their larval development. The bodies of the mature insects are, for the most part, oblong, of a brassy lustre, or beautifully colored with metallic green, blue, red, black, and yellow, and their general resemblance is to some of the Longicornia, except that their antennæ and legs are much shorter than those. The larvæ are whitish or yellowish fleshy grubs, with the anterior segment much dilated or enlarged, somewhat approximating to the form of the *larvæ* of the Longicornia, but more tadpole-shaped, the segments of the body tapering from the third one gradually to the terminal one, like a reptile's tail. These insects walk sluggishly, but in warm, sunny days they are very expert in the use of their wings. Although the larvæ bores into the wood of trees, yet the mature insects in many instances feed upon the pollen of flowers, or upon the honey dew and tender leaves of trees and plants. Some of them are exceedingly injurious to apple and pear trees in their larva state, and also to cedars and pines. Some of the species, like the *Longicornia*,

require several years to perfect their larval period, and very singular instances of their longevity under certain circumstances have been observed and recorded. It is said that a species of Buprestes was found alive whilst endeavoring to extricate itself from the wood of an old desk that had stood in one of the offices of Guildhall, London, for a period of twenty years. The plank from which the desk was made had been imported from the Baltic. This I record on the authority of Westwood, who quotes it from the 10th volume of the *Linnæan Transactions;* but a case came under my own observation of a species of Buprestes coming out of one of the feet of a sofa some five or six years after the piece of furniture had been finished and in use. I can only introduce two examples of this family in the present article, but these may suffice to impart an idea of the general form of both the mature insect and its larva, although there are various modifications of these forms among them.

Figure 53 is our largest species in Pennsylvania; it is the *Chalcophera virginica* of Drury. This insect is a pine tree borer, and is often very injurious to those trees. It is becoming more numerous in eastern Pennsylvania every year, the larvæ being, no doubt, brought hither in the timbers that are brought every spring down the river Susquehanna. The length of the insect is from an inch to an inch and a quarter, and the form is oblong oval. The color is a deep brown, with a bronzed or metallic lustre, but occasionally it is nearly black. The upper side is roughly punctured, having a number of polished elevations, and the lower side is beautifully bronzed. This beetle appears usually about the 1st of June, and may be found basking in the sun on the southern side of trees, fences, and shrubbery.

Figure 54 is the larva of a species of *Buprestes*, to which the present subject is very nearly allied. The head is small, and the mandibles are short, stout, and sharp; the first segment is very broad and short, the second one being both broader and longer, but the subsequent ones are all very much nar-

Fig. 53.

Fig. 54.

Fig. 55.

Fig. 56.

rowed. These larvæ fall a prey to various kinds of woodpeckers, who are very assiduous in their pursuit of them, and destroy numbers every year in such localities as they are not disturbed in.

Figure 55 is a smaller Buprestidæ, and is the *Dicerea divaricata* of Say, *now*, however, belonging to Kirby's genus *Stenurus*. This is the divaricated Buprestes, and attacks the wild cherry as well as the domestic cherry trees, and also the apple and the pear, although it is not as frequently found upon the latter as a smaller species belonging to a different genus, *(Chrysobothres femorata*, Fab.) The insect under consideration is about three-quarters of an inch long, and all over of a bright bronze color. The elytrons taper into a point, the two ends separating slightly, or "divaricating," from whence the specific name is derived. It makes its appearance in the perfect state in June, and continues until August or September.

Figure 56 is the larva, a white grub about one inch in length, and very similar in form to 54, only smaller and more tapering. These larvæ are frequently

found in the branches and trunks of old apple trees, or in those trees that have been previously enervated or weakened by the attacks of the *saperda* at or near the roots. This and kindred species of larvæ are the worms that the industrious little woodpeckers—commonly called "sap-suckers"—are in pursuit of when they peck those small holes in the trunks and branches of apple and pear trees, and not for the purpose of sucking out the sap, as has been erroneously supposed. Dr. Harris says he has also found the larvæ of these insects in peach trees, and that their location is often indicated by the exuding gum, both in the peach and the cherry tree. About one hundred and fifty species of *Buprestidæ* are known to inhabit the United States and Territories, boring into and feeding in the larva state upon the different kinds of domestic and forest trees, in many instances greatly to their injury.

The *Elateridæ* differ very materially from the foregoing family, both in regard to the perfect insect and the larva, although many of them are similar in their habits, this being the particular group to which has been applied the names of "*spring beetle*," "*hammer bug*," &c., from the well-known faculty they have of throwing themselves upwards or on their feet again when they are laid on their backs, by a quick jerk of the head and thorax. This is caused by a short, blunt spine on the under side of the thorax, between the bases of the anterior pair of legs, the point of this spine being usually concealed in a corresponding cavity behind it. If the insect is laid on its back, or by any accident is thrown into that position, its legs are too short to assist it in resuming its natural position, and therefore, by a muscular expansion and contraction, the fore-part of the body is thrown backward, and then suddenly forward, by means of the spine sliding again into its groove, throwing the insect upward, and allowing it to fall upon its feet again. Some of these *Elateridæ* are wood-borers, and others live upon the roots of various kinds of vegetation under the ground in their larva state, when they are extensively known as "wire worms," from the cylindrical form of their bodies, and from the hard and smooth integument that surrounds them.

Fig. 57.

Fig. 58.

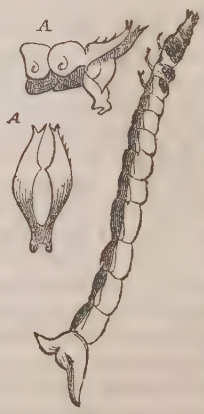

Fig. 58 *a*.

Figure 57 is the largest and one of the most common—although not the most abundant—species we have in the United States, and is one of the most familiar, on account of its color and peculiar markings. This is the *Alaus occulatus* of Linné, and varies from one inch to one inch and three-quarters in length, and three-eighths of an inch broad across the widest part of the thorax and wing covers. The color is black above, profusely speckled with white, and upon the thorax are two black, velvety, eye-like spots, surrounded by a ring of white, from whence the insect derives its specific name. Figure 58 is a lateral and

dorsal view of the larva, a yellowish flattened grub, nearly two inches in length, with six short brownish legs, and a large deep brown or nearly black head, and strong jaws. The first segment of the body is the largest, and is also of a dark brown color, the second and third segments being shorter and a lighter brown color. Each of the other segments are smoother and of a deeper color on the upper side than they are on the under side. The caudal segment terminates with two bifid spines, having three additional spines or teeth along the margin on each side of them, all of a brownish color, and a number of little warts on the upper side and near the end of the segment. Below there is a large retractile wart, or a proleg, armed with two brownish central spines, and three or four smaller ones on each side of them. These larvæ are found in oak, apple, locust, and other trees, in the decaying parts of which they feed and undergo their transformations. Some of these larvæ attain to two and a half inches in length before they assume the pupa state, and require two or three years to mature. They make their appearance in the perfect state in the months of May and June. Figure 58, *a*, is a lateral and dorsal view of the terminal or anal segment

Fig. 59

Figure 59 is a very common and a very abundant species belonging to this group of insects. It is the brown "click beetle," or *Cratonyclus brevicalis* of Herbst. The length is about five-eighths of an inch, and the color of a chestnut brown. The thorax is smooth, the wing-covers longitudinally lined, and the antennæ slender, but distinctly serrated. Figure 60 is the larva, a hard, smooth, pale brown, wire-like worm, with six short feet, a small dark head, and the anal segment terminating with two small sharp spines. It has also a small retractile spiny prop foot under the last segment. Feeds on decaying oak and other woods, and is found in great numbers from May until December, hibernating during the winter in the mature state under the bark of old stumps.

Fig. 60.

LONGICORNIA OR CAPRICORN BEETLES.

The largest, most conspicuous, and most universally destructive tribe of wood-boring coleopterous insects is that which is denominated the long-horns, (*Longicornia,*) or Capricorn beetles. The antennæ of these insects are nearly always as long as the body of the males, and in many instances two, three, or four times as long, usually bent round like the horns of a goat, when the insect is in a state of rest; hence the common name of "Capricorn beetle." These insects are in nearly every instance wood-borers in their larval period, and live in the interior of trees, shrubs, and old rotten wood, or in dead wood; only a very few have been known to attack the roots of vegetation. The larva is a long whitish or yellowish grub, with short, thick, and strong triangular jaws, capable of cutting a passage through very hard and solid wood, upon which alone it feeds during the larva state. As some of these grubs attain a large size, in some instances two and three inches in length, and as they remain in the larva state from one to five years, or even longer, they are capable of doing much damage to fruit and forest trees, as well as ornamental trees and shrubbery, and also to cut timbers, pailings, door and window frames, or any other lumber into which the eggs may have been previously deposited. These larvæ are either destitute of feet, or have them either very small or rudimental, but there are small rough protuberances upon the segments of the body, both above and below, by means of which they force themselves through their passages in the interior of wood or trees. The head is usually of a moderate size and partially retractile in the first segment of the body. The segmental divisions of the bodies of these destructive grubs are usually very distinct and prominent, consisting of twelve in number, and an additional terminal lobe of greater or lesser magnitude. The anterior segment is usually the largest, and then follow two or

three short ones; and although those that follow these are longer, yet the body gradually diminishes in diameter towards the end. When the larva state is fully matured, the insect approaches the surface of the tree or timber in which it was reared, and there in a cavity previously prepared, and surrounded by a rude cocoon constructed out of woody fibre of its own cutting, it is metamorphosed into a pupa, which, after a longer or shorter period, according to the season, or the particular species, comes forth a perfect insect, gnawing its way through the pupa case and the epidermis or bark of the tree or timber.

The perfect insect is distinguished by an oblong body tapering more or less towards the hinder extremity; the thorax usually short and less in width than the body; the head provided with a powerful pair of jaws of more or less prominence; the legs moderately long and stout, terminating with four flattened tarsal joints; and the antennæ or feelers, as before stated, long, setaceous or filiform, that is, bristle-like or thread-like, but jointed and thickest near their base. The eyes are either divided into two parts, or kidney-shaped, or notched, (*emarginate.*)

The ligniverous habits of the Longicornia or Capricorn beetles may be inferred from the fact that where the greatest woods and forests abound, there these insects are also most abundantly found. Naturalist travellers have observed that the thickly-wooded districts of South America possess a far greater number of species and of individuals, and these of a larger size, than are to be found in corresponding latitudes on the continent of Africa. These insects abound in the pine regions of Pennsylvania and other States, and are brought down the streams into the lower counties in timber and lumber every spring, and it is more than probable that many species may become domesticated among us, as those which attack our fruit trees have already been. A singular instance of the longevity of the larvæ of some of these Capricorn beetles is recorded in the "Country Gentleman," vol. ix, p. 78, and elsewhere, of one of them coming from an old apple table-leaf twenty-eight years after the tree from which it had been made was cut down. It was known as the "Putnam table," and was owned by a son of General Putnam, of happy revolutionary memory. This may illustrate how insects may be carried from one country to another, and finally colonized and localized in places remote from their native haunts.

PRIONIDÆ OR PRIONIANS.

The tribe *Longicornia* is susceptible of many minor divisions into groups and families, but I shall restrict this paper to their consideration in the three great groups usually recognized by authors on the subject, namely, the *Prionidæ*, the *Cerambycidæ*, and the *Lepturidæ*, or, perhaps more popularly, the Prionians, Cerambycians, and Lepturians, a few common species of each of which will be cited, in order to assist in the illustration of their singular and interesting histories.

The *Prionians* derive their name from a Greek word which signifies a *saw*, on account of the flattened joints—of most of the species—in the antennæ, giving them a serrated or saw-toothed appearance along the inner margin of them. This name may also be derived from the toothed structure of the inner margin of the mandibles or jaws of some of the species. It has been stated on various authorities that some of these beetles have the power to saw off stout twigs from trees, by clasping them in their jaws and then whirling around sideways until it is separated from the parent tree, but the damage done by them in this manner must be comparatively very insignificant. This group includes the largest species belonging to the tribe Longicornia; some of our native ones measuring two or three inches in length and an inch in width. The larvæ of this group are more flattened than those of the other groups of the same tribe, and are moreover provided with six short legs, which, however, do not seem to be of any ad-

vantage in their locomotion outside of their burrows. These larvæ are usually found in old dead or decaying wood and timbers, especially in the decaying interior of the trunks of the Lombardy poplar and the silver-leafed poplar or balm of gilead. The imago or perfect insect only flies abroad at night, and in daylight keeps itself hidden under the loose bark of old logs, or any other appropriate and convenient hiding-place. When captured, these insects, as well as many others belonging to the same tribe, have the power of making a screeching noise, caused by friction, in the rapid bowing and raising of the head. The females in this group are usually much larger than the males, with shorter and thinner legs and antennæ. There seems to be a correspondence between these insects and the forest trees of the countries which they inhabit; for instance, I have a species from California, *(Prionus Californica,)* the female of which measures over two and a half inches in length, whilst the largest female I have from the State of Pennsylvania is only one inch and three-quarters in length. It is a *Prionus laticollis*, Dru. Again: a Brazilian species before me measures over three inches in length, *(Caliphagon barbatum.)* The most beautiful species belonging to this whole group is from Colombia, South America, and is the *Trictenotoma childrenii* of naturalists. It measures three inches in length, including the mandibles, and the legs and antennæ are more slender, longer, and neater formed than any of our native Prionidans. The whole is of a most beautiful metallic green. Each of the mandibles have an internal hook, and the form of the anterior pair of legs is decidedly raptorial. This would seem to imply that this insect is carnivorous in its habits—a character that differs materially from what is known of the group in general, for it is recorded that the mature insect of some of the species attacks the tender buds of trees.

By far the most common and the most numerous species in this latitude is the brown or cylindrical Prionus *(Prionus cylindricus*, Fab.,) and the one most familiar to amateur naturalists. The larvæ of this insect inhabits pine trees, and is capable of doing much injury. The body of the perfect insect is from an inch to an inch and three-quarters long, narrow and flattened, and the color is of a uniform bay-brown, the head and antennæ being a shade or two darker. The thorax is short, and armed on each side with three sharp spines; the wing-covers are nearly of an equal width throughout, and have three longitudinal elevations

Fig. 61.

Fig. 61, *a*.

Fig. 62.

or ribs on each of them. Figure 61 represents the imago, and figure 62, the larvæ of this insect. Not enough of its habits are known to identify it as being destructive to fruit trees, but from the fact that it is a "pine-tree borer," and that

it is quite common in eastern Pennsylvania, ornamental and forest pines in this latitude may not be long exempt from its depredations. Figure 61 *a* is the caudal extremity and ovipositor of the female.

The largest species of Prionians that we have east of the Rocky mountains, or at least the largest known in the eastern and middle States, is the *Prionus laticœllis* of Drury. The females of this species often reach two inches in length and three-quarters of an inch in width, although ordinarily they are but an inch and a half long and half an inch broad. The color is a uniform pitchy black, and the whole insect is more robust than the *Cylindricus*. The jaws are short and strong; the antennæ are stout and serrated in the males, but less conspicuous and more filiform in the females. The thorax is smooth and wider than the former-described species, but the wing-covers are rugose or rough, with a multitude of small irregular punctures which run into each other. The grubs of this species often get as large as an ordinary man's thumb when fully grown, and are found in old decaying wood or in the interior of old poplar trees of various species, about the trunks of which they are often found flying in the evenings, during the months of July and August, in the perfect state. The females of all the Prionians are provided with a retractile ovipositor, by means of which they introduce their eggs between the crevices of the bark or into in-

Fig. 63.

Fig. 64.

cisions which they first make with their powerful jaws. Figure 63 is the perfect insect, and figure 64 is the larva of the *P. laticœllis*. Although I have often found these larvæ in the places where the mature insect was also found, yet, as I have none of them now in a state of preservation, therefore those here figured are drawn from memory, assisted by drawings of analogous foreign species by Westwood. I omitted to say that this species is provided with the three thoracic teeth or spines, which are usually found more or less developed along the lateral margins of the thorax of the group to which they belong.

In thickly-wooded countries, and where the rapid decomposition of old timber is an object, these Prionians are of eminent service; but where it is otherwise, they are capable of doing much injury, and are liable to do so. It might be of some service to institute a commission to inquire whether the almost universal decay of the Lombardy poplar trees in the middle States is not caused by these and kindred species of wood-boring insects.

As to artificial remedies for their destruction there does not seem to be any better than building fires at night in the localities where they abound, and attracting them into them. They burrow too deep into the wood to be dislodged

by woodpeckers, and from the same cause they are out of the reach of most species of parasitic insects. There is not a doubt, however, but that many of them fall a prey to their natural enemies. The two species above described may be regarded as appropriate types of the group to which they belong; but, in addition to these, there are already described at least ten species of *Prionus*, three of *Spondylus*, four of *Mallodon*, one of *Trichocnemus*, one of *Derobrachus*, and some others, that may be referred to the same group, all inhabiting the United States. The agriculturist, the timber-grower, the amateur, or the novice, may make himself sufficiently acquainted with these insects from the foregoing descriptions, assisted by the illustrations, in order to detect and identify them, and to apply such remedies for their extermination as time and experience may suggest.

CERAMBYCIDÆ OR CERAMBYCANS.

The next group of the Capricorn-beetles to be considered, namely, the Cerambycans, is much more numerous than the former one, although the individual species are not nearly so large in size. These insects include some of the most destructive kinds to fruit and ornamental trees, that have been domesticated among us. The heads of this group are verticle, and the jaws less prominent than in the preceding one. Their eyes are always or nearly always reniform or kidney-shaped, and the antennæ are not serrated or saw-like, but slender and often very long, especially in the males. The thorax is also longer and more convex than in the Prionians, not having the thin lateral margins of the former, but, on the contrary, often much rounded. Most of these insects are distinguished by long, narrow wing-covers; some of which are armed at the apex with one or more little thorns or spines, and some have also a tooth or thorn, more or less acute, projecting from each side of the thorax.

The larvæ of these insects are long, soft, and fleshy grubs, of a whitish or yellowish color, with a scaly head, and armed with two powerful jaws, and six very minute feet. Each of the segments is dorsally provided with a broad and rough tubercle by means of which the grub works its way through its passage. They remain two or three years in the larva state, and like other wood-boring insects, before they change into a pupa, they turn their burrows horizontal with the anterior end towards the surface of the tree, lying just beneath the bark. After their last change, they use their sharp jaws to cut their way out into the open world to lay the foundation of new and increased colonies of destructive grubs. Some of the larvæ of the Cerambycans feed upon the pith of shrubbery, and undergo their transformations therein. The mature insects usually hide themselves during the day, and fly abroad in twilight, or after dark, but a few go abroad during the day and feed upon the pollen of plants. It would be impossible, in a limited article, to mention all the representative species or even genera or families, and therefore I will confine my remarks to a few species that are found in the greatest abundance, and hence the most common, in the middle States.

One of the largest species of Capricorn beetles belonging to this group is the *Monohammus titillator*, or "tickling beetle." This insect is from three-quarters to an inch and a quarter in length, and the antennæ of some of the males are considerably more than twice the length of the body, bristle-shaped, and tapering gradually to the end. The head is verticle in these insects, carried very much like the head of a goat; the eyes are oval and located immediately beneath the base of the antennæ; the thorax is round in front and behind, but the middle projects out on each side in a sort of wart or rough tooth. The anterior legs are rather the longest and the tarsal joints much dilated. The color of the whole insect is a brown, mottled with specks of gray or white. On the upper edge of the middle legs is a small obtuse tooth, but in some individuals

this is hardly visible. This insect (figure 65) emerges from the pupa state during the months of June and July, and may then be seen three or four together, the males paying court to the females, agreeably to the observations recorded by Dr. Harris. The larvæ of this insect is evidently a pine-borer, for I have found it about saw-mills, and in pine timbers from which the mature

Fig. 65.

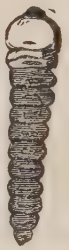

Fig. 66.

Fig. 67.

insect came forth. Figure 66 is a larva* of a representative species, which is introduced to show the general form, in order that it may become impressed upon the mind and memory of the husbandman and amateur. Indeed, there is greater uniformity in the shape and structure of the larvæ of the *Longicornia* than there is in any other group of coleopterous insects. Figure 67 is the pupa.

Bearing some resemblance to the preceding insect, only more slenderly formed, is the "hickory tree borer," (*Chion garganicum.*) This insect is about one inch in length, of a hazel color, and covered with very short hairs, which gives it something of a grayish color. There is a more or less distinct oblique, yellowish band across the wing-covers in front of the middle. There is a small acute spine on each side of the thorax, and also two smaller ones at the end of each wing-cover. The antennæ of the males are fully twice the length of the body. Figure 68. This is the insect that is said to have come forth from the leaf of the Putnam table, alluded to by Dr. Fitch and others, some eight and twenty years after the apple tree had been cut, out of which the table had been made. It is, however, known to be destructive to hickory trees. The hickory tree worms I have often seen, but having none to refer to now, figure 69, the larva, is only approximately introduced, from a drawing by an amateur.

The mulberry tree in Pennsylvania has an enemy in figure 70, *Dorcaschema wildii*, (Uhler,) or "mulberry borer." The insect is three-quarters of an inch long, with the antennæ nearly twice that length. The thorax is without a spine, and is cylindrical; the feet much shorter proportionally than the former two species;

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* Since writing the foregoing, I have received the following from Mr. P. Uhler, of Baltimore: "I guess you are right in supposing the larva of *Monohammus titillator* (Harris) to be brought down the Susquehanna in pine logs. It is found in pines in New York, from whence the river flows. The larva is a 'large, white, flesh-like grub, nearly cylindrical, without feet, with numerous fine hairs of a fox color, with fourteen segments, the second being larger, flattened, horny, inclined obliquely downward and forward; the next ones very short, and all the following except the last one with a transverse oval rough space above and beneath. Its pupa state is passed in the interior of wood, into which the larva bores a cylindrical hole transversely, and which, when the perfect insect gnaws its way out, is nearly large enough to admit the little finger.' It appears abundantly in some parts of New York State in July, sometimes doing extensive damage to the pine trees."

the color is gray, mottled, or spotted with dark brown. Figure 70 is the imago, but the larva is unknown to me. It comes forth from the pupa state in the months of June and July, and is figured here on account of its abundance

Fig. 68.

Fig. 69.

Fig. 70.

the past season. Whether it attacks other trees or not I do not know, but from its approximation to the saperdans, the inference is that it may in time become an enemy of the mulberry, of silk cocooneries, and also other trees.

The black and white oak trees are infested with an insect that may be an enemy or a friend, just in proportion as the health and thrift of the tree is advanced or retarded by moderate or immoderate pruning. This insect is the "Oak-pruner," of Professor Peck, of which there are several species. Although I have introduced figure 74 *(Elaphidion alternatum)* as the representative of this genus and of this portion of the Cerambycans, yet the *E. putator*, a smaller species, is most abundantly found in this latitude. The general appearance and the color of all the species are nearly the same, but they differ very materially in size and proportion. The species figured is seven-eighths of an inch in length; of a light brown color, mottled with a dull white; the antennæ are fully the length of the body, with a small spine at the third, fourth, and fifth joints, along the inner margin; the thorax is barrel-shaped—that is, swollen in the middle and narrowing towards the anterior and posterior margin; and there are two spines or thorns at the end of each wing-cover. The females lay their eggs in the month of July in the axils of the leaf stock or of a small twig of the black and white oak, near the extremity of the branch, according to the observations of Harris and Peck. After the grub evolves from the egg it penetrates the twig until it reaches the pith, from whence it continues its course towards the body of the tree, increasing in size, and devouring the pith and the surrounding wood of the branch, forming a cylindrical burrow several inches in length. After the grub has attained its full size, which usually occurs at the end of the summer, it divides the branch from the tree, having first closed up the lower end of its cell, and then undergoes its transformation to the pupa state. As the branch is only held to the tree by the outer ring of bark, the first autumnal wind breaks it off, and it falls to the ground, and in the following month of June the imago comes forth. The larva, figure 69, is a whitish grub, of an inch in length, not differing materially from other larvæ belonging to this group. The remedy for the destruction of these insects is very simple, and consists merely in gathering up the twigs that have fallen down during the fall and winter and burning them. About twenty-five American species of these Elaphidians have been described by entomologists.

Fig. 74.

Pine and fir trees, which, from the resinous odors and liquids oozing and exhaling from them, it might be supposed would repel insects in general, but this is not universally the case, for there are several species of Capricorn beetles that

are particularly partial to these trees. Figure 75 *(Callidium violaceum)* is one of them. This insect is about half an inch in length and of a Prussian-blue or violet color; the thorax is oval transversely, and has a downy covering. The wing-covers are flattened and rugose, with irregular punctures. The larva, figure 76, is about three-quarters of an inch in length when mature, much more flattened than many others of this group, and they have six very small legs, but very powerful short jaws. They burrow immediately beneath the bark of the pine trees or logs, and in company with a black species with two whitish blotches on the wing-covers, *Callidium (cucujus) bajulus*, they are very destructive, often separating the entire bark from the trees. These insects may be found in this locality from the end of May until the end of June, and the larva is often found in splitting pine wood, or in its earlier stages under the bark, for it requires two years to mature. The *Callidium violaceum* is also found in Europe, and Professor Peck was of the opinion that it was carried there in pine timber and lumber from this country. The black species *(bajulus)* was certainly imported from Europe into this country; but the exchange is not a fair one, as the latter insect is by far the most numerous and destructive. The astonishing power of the jaws of this latter species is recorded by Kirby and Spence. Some of them emerged from an old rafter and eat their way through sheet lead or zinc, the metal being afterwards found in their stomachs. We have little or no pine growing in this locality, and yet every season I find an abundance of these insects, but they are more common along the Susquehanna. The *C. violaceum*, before it undergoes its final transformation, bores into the solid wood of the tree in a horizontal or transverse direction. Woodpeckers are the natural enemies of these insects, and vast numbers of the grubs fall a prey to their rapacity every season. On one occasion I found a large number of the *bajulus* about an old wood-pile in company with another quite as common a species of insects, and I suspected that they both came out of the *oak wood*, although it was not the original element of either of them.

Fig 75.

Fig. 76.

One of the most common and familiar species of the Cerambycans is the "locust tree borer," (*Clytus robinia*,) and also one of the prettiest and most destructive. This insect is not so completely nocturnal in its habits as many of the others of the same group, but may be seen in great numbers during the months of August and September upon the golden-rod, feeding on the pollen of the flowers, in company with one or two species of Telephorians. This insect varies in size from a half inch to seven-eighths of an inch in length, and the antennæ of the males are fully of the same length. The thorax is more oval than in *Callidium*, and the whole body is more rounded. The body is of a velvety black color, with transverse yellow bands on the head, thorax, and wing covers, the first and second of which from the base are V-shaped. The antennæ are a dark color, and the legs are all yellow. Some forty species of these insects are known to entomologists, but the habits of many of them are yet unknown. In the month of September the females deposit their eggs in the crevices of the bark of the locust tree, and the young grubs, as soon as they are hatched, burrow into the bark, feeding upon its soft inner substance, and there, on the approach of winter, remain torpid until the following spring, when they bore further into the solid wood in an upward direction. Figure 71 is a male imago; figure 73 is the pupa; and figure 72 the larva, a yellowish or dirty white grub, about an inch in length, footless and fleshy. These insects require only one year to accomplish all their transformations, for in the months of August and September those hatched from the eggs of the previous season come forth perfect insects. My own individual observations upon this insect

are to the effect that they do not confine their destructive operations to the locust trees alone, but are also destructive to others, and especially to young hickory. I on one occasion saw a large number of hoop poles entirely destroyed

Fig. 71.

Fig. 73.

Fig. 72.

by the larvæ of these insects, from the burrows of which the mature insects came forth in great numbers. I have also seen them issue forth from old knotty sticks of hickory wood that remained over winter in the cellar. As the females deposit their eggs in and during the month of September, therefore, wood, timber, or hoop poles cut prior to that time would be more likely to escape the ravages of the "worm" than if they were cut subsequently, or after the eggs had been already deposited therein. Whitewashing trees has been suggested as a remedy against these insects, but the most reliable plan for their destruction would be the employment of suitable persons to take them by hand and immerse them in boiling water or throw them into the fire. One or two hours a day might be profitably spent in this employment by persons who are capable of doing little else; but where the number is large, and the district infected also large, the labor would be almost insurmountable.

Fig. 77.

Fig. 78.

Fig. 83.

Probably the *most* wide-spread and universally destructive insect to *fruit* trees is the "apple tree borer," (*Saperda bivittata*,) and which has hitherto almost defied all the efforts resorted to for its extermination. Figure 77 is the imago, figure 78 the larva, and figure 83 is a transverse section of an infected trunk. These insects deposit their eggs in the trunks of apple trees near the

ground, and the grub works its way into the solid wood, where it passes the first year of its larvahood immediately beneath the bark, eating its way both upward and downward in a widened burrow, which it fills up after it with gnawed particles of woody fibre or sawdust-like garbage. The second year they may be found, considerably increased in size, imbedded in the solid wood a little further in from the surface, and the fibre which fills the burrows which they have made is much coarser and longer, and seems to have been driven in with a caulker's chisel. The third year they increase the size of their burrows and gnaw out towards the surface of the trunk, assuming a horizontal instead of a vertical position, and in a sort of rude cocoon, cemented together from the fibre that surrounds them, and with the head outward, they change to a pupa, and in the month of June cut their way through the bark by means of their sharp and strong jaws, and come forth a perfect insect, about three-quarters of an inch in length. The color of the upper part of the thorax and the wing covers is a light brown, with two white longitudinal stripes from the head to the end of the elytrons; the head, the feet, the antennæ, and the whole underneath of the insect is a mealy white; and the eyes are a dark brown, and notched, to admit the base of the antennæ. The mature larva is a yellowish white, fleshy grub, and fully one inch and a quarter in length; the head is a light brown, and the feet are merely rudimental; the segmental divisions are very prominent, projecting in tubercles above and below; the first segment is large and flattened, which is the case with all the larvæ belonging to this group.

Various remedies have been suggested for the destruction of these insects, the most reliable of which, in my estimation, is for all fruit-growers to make themselves acquainted with the history and appearance of them in their various forms. The first season after the eggs are laid by the female beetle, the young larvæ may be found immediately beneath the bark, and a portion of their cuttings will be found at or near the place of ingress. Under these circumstances they may be cut out with a sharp instrument or reached with a sharpened wire, and thus destroyed, but the second or third year they are not so easily reached without injuring the tree. When, however, the mature insect can be identified, and the season of its appearance and departure known, the trees may be protected against them about the trunk and roots by various contrivances, such as are usually resorted to for the protection of the peach tree. June seems to be the month in which they are the most active in the perfect state, and after the 1st of July they are rarely seen except, perhaps, an occasional belated straggler. Their native wild tree is the hawthorn, and the fact that they are partial to *young* apple trees may suggest the propriety of surrounding apple orchards with hawthorn hedges, to attract the beetles, and there leave them to the mercy of the birds. I have often found them concealed among the leaves of these hedges during the day, from whence they issue in the evening.

Fig. 79.

Fig. 80.

There is another species of these insects that bores into the linden trees, (*Saperda vestita.*) Figure 79 the imago, and figure 80 the larva. This insect is about the same in size as the former, and makes its appearance and departure about the same season The difference in the appearance of the larva is very trifling, but their habits are dissimilar. The *vestita* attacks the linden trees both in the trunk and in the branches, sometimes totally destroying the vitality of one side of the tree before attacking the other. Coming forth in June, oftentimes in great numbers, the mature insect is also destructive to the tender and young foliage of the trees at the ends of the branches, whereby they become disfigured and stunted. This is the insect that in times past has been so destructive to the linden trees on Boston Common and in the public squares of Philadelphia. It is becoming fearfully abundant in the interior of Pennsylvania,

and especially in Lancaster county. The best thing that can be done when they become very abundant in trees is to cut them down and burn all the infected part.

Allied to the two immediately preceding insects is the "raspberry borer," (*Oberea tripunctata.*) This insect is about half an inch in length, and cylindrical in form. The color of the whole insect, except the thorax, is black; the thorax is a rusty yellow or yellowish brown, with three black punctures or spots on the top of it. The antennæ of the males are nearly as long as the body.

Fig. 81

Fig. 82.

Fig. 84.

Figure 81 is the imago; figure 82 is the larva, a whitish cylindrical grub, thickened towards the anterior; and figure 84 is a section of an infected raspberry cane, showing the manner in which the insect girdles it at the time she deposits the eggs. At the place where the mature insect eats its way out of its burrow the cane becomes so much weakened as to break off the first wind that blows. The larva feeds upon the pith of the raspberry, and finishes its transformations about the 1st of July or later—sometimes near the end of the month—and the females deposit their eggs in the beginning of August. Figure 84 is an infected raspberry cane.

This brief sketch must conclude my remarks upon the second group of the CAPRICORN beetles, and the concluding lines will be devoted to a short sketch of the *Lepturians.* I wish I could suggest some convenient, cheap, and reliable remedy for the destruction of these insects, but can do nothing more now than to recommend observation and the most minute watchfulness on the part of farmers and fruit-growers. When they are able to recognize the insect when seen, either as a worm or a perfect beetle, they may then be enabled to apply some remedy for their destruction. Picking them by hand as they come forth is the most effectual remedy I at present know, but doubtless some labor-saving or self-acting device may yet be discovered for their extermination. It is scarcely necessary to say that the apple tree, of which figure 83 is a transverse section, became too much weakened to ripen its fruit, and finally, after a period of languishment, died.

The third and last group of the Capricorn beetles is the *Lepturidæ* or Lepturians, nearly corresponding with the Linnæan genus *Leptura;* and comprises those Longicornia that have the thorax narrowed in front, from which the head is separated by a neck. The eyes are not so deeply notched as in the other groups of the same tribe, but they are more oval and prominent, and more distant from the base of the antennæ, which are nearer the middle of the head. The base of the wing covers are much wider than the base of the thorax, and the former taper towards the apex or ends, from which circumstance this group derives its name, *leptura,* litterally meaning narrow-tail.

These insects are diurnal in their habits, visiting flowering plants in the warmest and sunniest part of the day, especially umbelliferous plants. There are many beautiful and neatly-marked species among them, but few of them

that are large in size. The largest and finest species we have in Pennsylvania, and also the most common, is the *Desmocerus cyancus*, (Fab.,) or "elder borer." This insect is found about the common elder from the middle of June until the middle of July, and the grubs undergo their transformations inside of the elder canes, and feed upon the inner pith in the lower part of the stem. This insect is about an inch in length, and the whole body, including feet and antennæ, is a deep violet or Prussian-blue color, except nearly the one-half of the forepart of the wing covers, which are an orange color. The larvæ of most of these Lepturians are more broad and flattened than the former groups, and do not taper so much towards the end. They are also provided with six feet, something more prominent than the others, but still not sufficiently so to make them conspicuous. Indeed, these organs do not seem necessary in the larger number of wood-boring insects in their larvæ state, and therefore they are almost destitute of them. Figure 85 represents this insect.

Fig. 85.

Fig. 86.

A very common representative of the Lepturians is the lineated pine beetle, *(Rhagium lineatum,)* so named from its having three elevated longitudinal lines on each of its wing covers. Length from five to seven-tenths of an inch; color variegated with reddish, ash, and black; antennæ as long as the head and thorax; the thorax swells out in the middle to an acute tubercle on each side, and is narrower than the base of the wing covers, which taper moderately towards the hinder end, coarsely punctured all over between the lineations. Figure 86, the mature insect, and figure 87, the larvæ, a broad whitish grub about an inch in length, very destructive to pine trees; often found in immense numbers immediately beneath the bark, causing it to fall off in large pieces, often entirely killing the tree. Every year becoming more abundant in the eastern section of Pennsylvania—possibly brought down the valley of the Susquehanna in pine spars.

Fig. 87.

Fig. 88.

Figure 88, *Leptura vittata*, is a very common species in Lancaster and York counties, in Pennsylvania, found upon a variety of flowering plants in June and July. This insect is about three-quarters of an inch in length, of a smooth black color, with a longitudinal brownish line upon the middle of each wing cover. The antennæ are about half the length of the body, and the thorax is much narrower than the head in front, making the neck very distinct; ovipositor of the females much exserted. It is a wood-borer, but although very common, yet much of its habits are not known. Figure 89 is supposed to have been the larvæ of this insect, and is only approximately introduced.

Fig. 89.

Fig. 90.

In company with the foregoing, and even in greater abundance, is found (figure 90) *Strangalia luteiconies*, half an inch in length, and of a black color, banded and otherwise marked with yellow; form very slender, and the wing covers much narrowed at the ends. Its habits, other than its fondness for melliferous and polleriferous flowers, are unknown to me. It is usually found in deep forest land, or along the margins of streams where much wild elder is growing. Westwood asserts that *Strangalia* undergoes its transformations in old stumps in England, and their habits may be similar here.

About five hundred American species of these wood-boring Longicornia have been catalogued and described by various entomological authorities. Perhaps every single species of these has a natural enemy in some other creature belonging to the animal kingdom, and thus the great balance is preserved.

GENERAL REMARKS ON THE GRAPE-VINE:

ITS ORIGINAL HABITAT, DISTRIBUTION, AND MULTIPLICATION OF VARIETIES.

THE grape-vine has already in the remotest antiquity attracted the attention of man; the art of making from the juice of its berries a fermented beverage has been early invented, and continued to be practiced as far back as history reaches, with more or less success. Noah is said to have cultivated the first vine in Palestine 2,350 years before Christ. Under Cecrops, 1,600 years before Christ, the culture of the vine and the fruit tree has been brought to Greece. It seems, however, that the culture of the vine can still further be traced back, its first traces being hidden in India. Nations acquired it thus from nations, who perished, giving way to others. The culture of the vine has not only been continued up to the latest times, but with the advancement of civilization it excited more and more interest; it has been improved, and continued to remain, with a great number of educated agriculturists and amateurs, an object of observation and investigation, while its product furnished to the poor vintner, if not a splendid, yet a steady living. The governments perceived, likewise, at an early stage, the importance of the culture of the vine. It was not merely from the want of a beverage that has become almost indispensable that it was industriously cultivated, but it has been planted almost at all places where there was but little prospect for its growth, in order to procure a living to the people, which was the more important, as the consumption at that time was of a much greater extent than at the present day. Every inferior nobleman, every monastery endeavored to plant a vineyard for their own use. It was, especially, the institutions of economy, contributing so much during the early centuries to the elevation of agricultural pursuit, which showed so much judgment in the selection of localities favorable to the cultivation of the vine, so that the choice localities were almost exclusively in the hands of the clerical order down to the latest times, especially in the northern part of Germany.

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Whether the grape-vine grew in Germany originally wild or not, cannot easily be ascertained; the latter supposition, however, seems not to be correct, because the northern nations formerly knew nothing of the vine, and became acquainted with the grapes only through the Roman and Grecian colonies. With their predilection, however, for the wine, which attracted whole colonies from Germany into the southern regions, and which induced the Roman emperors to prohibit altogether the cultivation of the vine in the adjoining provinces, so as not to increase the inducements for making invasions, the Germans and Gauls would certainly have used their native grapes for making wine if they had found any in their woods. There were, however, several varieties of the wild grape growing in the forests of the Caucasus, inducing the wild inhabitants of these mountains to make wine, though of a very imperfect character. The grape-vine seems to have come from Asia Minor, Palestine, and Egypt into Italy and Greece, so that these regions, favored so much in other respects by nature, may, in all probability, be looked upon as the original habitat of the European grape-vine; and it is probable that the grape-vine has, in still earlier times, been imported into these countries from regions still further east, as is indicated by the beautiful characteristic myth of the migration of Bacchus into India. * * * * *

It is true there are now wild grapes found in almost all countries where vine culture exists; but this cannot be looked upon as a proof of the grape-vine having had there its original habitat; it could rather be assumed that the seed

was carried there by birds, and that new varieties were produced in accordance with the peculiarity of the soil. * * * * *

According to the oldest reliable accounts it may be assumed that the grape-vine has first been cultivated between the 20th and 30th degrees of latitude, and that it was spread over the shores of the Mediterranean by Egyptian and Phœnician colonies. It was only after the climate of Gaul and Germany had become sufficiently dry and warm through the thinning out of the woods that fewer obstacles presented themselves to the culture of the grape, and that it was then more and more extended towards the north. At present, the vine is cultivated on the northern hemisphere, between the 15th and 51st degrees of latitude. In Germany, it reaches even the 53d degree.

It is remarkable that the northern border of the vine culture in Europe does not run parallel with the equator, but it advances from southwest towards northeast, progressing the further in a northern direction the more we advance towards east. There is a certain line seen running parallel with the coast range towards the northwestern oceans, caused perhaps either by the moister atmosphere in the neighborhood of those seas, or by the violent winds prevailing on that coast; perhaps it may be caused by the descent of the country in that direction, towards which so many ranges of valleys are sloping.

The grape-vine requires for its growth a warm place, though not too hot, and a certain, though not excessive, degree of moisture. This condition is found to exist the higher on the mountains, the further south; from the 40th degree towards the equator it is found to be more on that side, turned off the sun, and inclined towards the pole of the earth, because the effect of the scorching sun must the more be avoided the nearer the culture of the grape advances towards the middle of the globe. The reverse takes place towards the poles. The rays of the sun must here be absorbed and increased in a measure by the slopes of the mountains inclined towards the sun; they must also keep off the severe winds blowing from the poles, and if the moisture is not too excessive the grape there may still be expected to arrive at its perfect maturity. Especially favorable to the grape are the banks of those rivers which form not so much proper valleys between mountains as they form actual gulleys made by the torrents or the waters gushing from the plateaus. They usually afford more complete protection than real mountains. At the most northern frontier of the vine it is therefore cultivated almost exclusively in these river valleys. But where the rivers are running through level country towards the sea, as is almost always the case at a certain distance from the sea, there the cultivation of the vine ceases because it is no longer protected.

It is remarkable, however, that where the action of the atmospheric air of the ocean ceases, where the Scandinavian peninsula increases the breadth of Europe, and where the severe northern winds start, the culture of the vine suddenly recedes, taking up a firm position again only on the southern slope in Hungary. Whether the cultivation of the vine will penetrate further into Russia, as it was formerly the case in Germany, time will show. Similar to its former introduction in Gaul and Germany, it has been successfully introduced into the southern part of the Russian empire; how far its culture will succeed north depends upon the quality of the soil, its aspect, and the climate that may be expected, after it will have become more similar to that of other countries of the same degrees of latitude, through the advancement of a more intensive culture of the soil and clearing of forests. In Asia there is more or less opposition from the Mahometanism to the diffusion of the culture of the vine, so that it has not reached the northern border, to which skill and proper management might have been able to promote it.

Towards the south the culture of the vine it seems could be extended to the equator. The grape-vine is capable of enduring great heat, being cultivated in the district of Fayoum, Egypt, in a temperature of 40 degrees centigrade; like-

wise on the islands of the Green Promontory, between the 15th and 18th degrees of northern latitude.

The grape-vine being the offspring of a warm, though always moderate zone, there is nothing more injurious to it in a hot climate than an excess of moisture or dryness. The former causes too great a vital action; the latter oppresses it; and while the excess of the power of growth injures the quality of the grapes on the one hand, there will, on the other hand, no grapes be formed at all, owing to the excess of heat. Similar effects, though of an inferior degree, are already seen in the colder climate of Germany, as the same good product can never be expected from a vineyard of vigorous growth and moist locality, which will grow on localities of an inferior vegetation, the best wine growing where the vintner has to assist the power of growth; the grapes of the dry vineyards, however, being most exposed to being injured and scorched in dry and meagre years. So the varieties of the Riesling, being less juicy and having small berries, cease growing in Italy, experiments to plant them having totally failed, because they either dried up or showed such an exuberance in their growth that the fruit which commenced forming was again and again lost by shooting up and degenerating. Several attempts have also been made on the West India islands at planting grape-vines, but they were bound to fail because the exuberant growth of this plant, in the moist atmosphere of the south, had been lost sight of. This failure could have been avoided by selecting poorer and cooler localities of a higher situation, less promotive of the shooting up of the plant.

If there is a certain harmony of action required in regard to warmth, moisture, and fertility of soil, in order to raise a product adapted to making wine, there is always a considerable degree of warmth necessary for the development of the plant, an excess of this agency being the least injurious of all, provided the proportion of the other is not altogether injurious. But in the absence of warmth the grape-vine does not grow, however favorable the proportion of the other agencies may be. But if the excess of warmth is too preponderant, the grape-vine will likewise fail to thrive. * * * * * *

According to the general climatical influences the wine is also differently composed, especially as regards some parts of its compositions. The further south it has been growing, the more sugar and the less yeast is present. In the north the sugar decreases, while the fermenting substance increases. There is thus seen a certain gradation in the product of the wine, ranging from the poor and acid wines, and those that have no sugar on the northern wine border, down to a point where the sugar becomes so dense that it almost neutralizes the effect of the little yeast remaining, and that the must, in order to cause it to ferment, must be exposed to the sun or rarified by the addition of water.

A similar succession may be observed in regard to the aroma. This seems to be produced at a certain stage of the maturity of the grape. Before this stage has been attained there is no aroma discovered; after the maturity has passed that stage, the aroma is more or less covered by the amount of sugar. In presuming the aroma, at least one kind of it, to be the product of the skins of the berries, it is at the same time admitted that the various combinations of the different acids formed in the northern climates exercise likewise their influence upon the flavor of the aroma, as soon as these combinations form combinations of ether with the alcohol produced by the fermentation. There is likewise found a substance, known as extractive principle, in wines grown on northern but good localities, in especially favorable years. This substance combines with the oxygen of the atmosphere, and, according to the degree of these combination, produces flavors, known under the name of bouquet, which, however, do not exist in the wines of the south, being over-ripe and abundant in sugar. All these circumstances bring about a decided contrast between northern and southern products, being again connected only through a number of the most varied degradations—the bouquet prevailing in the former, while in the latter the sugar

and alcohol predominate. The former (the bouquet) seems, on the whole, to be more agreeable, (palatable, relished;) the Rhine wines, for instance, enjoying a favorable reputation all over the earth; so, too, the Germans, who immigrated into Greece, preferred of late the Rhine wines to the splendid wines of that country.

Inasmuch as the aroma is resulting from different causes, which, being so very much varied in their concurrence, are always producing new mixtures, there is always a greater variety observed in the northern wines. The southern products are more uniform in their character; and it is remarkable that if it is attempted to condense, artificially, the sugar of must from northern countries, by boiling, exposing the grapes for a long time on straw, &c., the original aroma is lost either by volitalization or by being covered (neutralized) by the amount of sugar and the preponderance of alcohol formed.

Towards north, from the 40th degree, the grape-vine requires a careful cultivation; it is more sensitive as to locality and soil; its harvest depends almost exclusively on a few degrees of heat, more or less, brought about by the weather of the summer, and is therefore much more uncertain. A considerable knowledge and experience are, therefore, required to succeed in the cultivation of the vine and to raise a good product.

At the 45th degree this difficulty is steadily increasing, the localities adapted become less, and reach hardly a moderate height; the grapes which are raised beyond this point rarely coming to perfection, the harvest of whole wine-growing countries being often entirely lost. The grape has no longer the same mixtures as in the south. The imperfect sugar is behind the predominant amount of acid and fermenting matter, the berry itself retaining too many watery parts. To produce good wines great skill and attention is required. The vintner has continually to struggle, not only against the inferior growth of the grape-vines, but, after the maturity, also against the climate, in order to save and perfect its product, inasmuch as all that has been acquired by industry and under the influence of the former favorable weather is but too often destroyed by cold and wet weather setting in too early.

But owing to the uninterrupted strain of this very attention and the continued struggle against the climate, the industry and the refinement was so much increased that these northern countries acquired a knowledge in the treatment of the grape-vine much superior to that of southern countries. This explains the fact that a much greater portion of the celebrated wines of France are produced in its northern half, while in proportion much less are found in the south, and that even those parts of the north are the most celebrated, for instance, the department of the Gironde, the location of which is the most unfavorable; it is thus further explained why a greater portion of celebrated wines enters the commerce from Germany than from Italy, and that the greater part of the celebrated wines of Hungary are produced in the north of that country.

If the grapes in the north do not attain their maturity they shrivel in a climate which is too hot, and become watery in great moisture. If too dry, they become slim and imperfect. In order to produce a good wine there, art must give its helping hand; the most favorable places must be selected, and the proper moisture be supplied by irrigation.

The zone most favorable to the cultivation of the grape-vine is that part of the globe lying between the 25th and 35th degrees. The most northern border at which it might grow, without requiring particular pains, may be set down as the 40th degree, while the 20th degree may be set down as the most southern border; beyond this border art must supply the wants of the climate by selecting the proper locality and treatment. On the southern hemisphere the grape-vine is already cultivated under the 8th degree in high localities, but the circumstances are not sufficiently known to enable us to draw conclusions.

Among the various countries of Europe, Spain and Portugal are most favored

by nature in regard to the cultivation of the vine. The 40th degree is running almost through their middle. There is no tract of land in Europe of the same high and steady temperature; the long range of hills extending from the Pyrenees to Cadiz and Portugal affords a number of excellent localities for wine culture. But notwithstanding these favorable circumstances there is but a small quantity of wine exported. Though this wine is known and relished in all parts of the world, the greatest portion in Spain itself is almost unfit for use, owing to its bad treatment; and for many excellent wines in the interior there are hardly any means of transportation towards the ocean, so that the wine culture of Spain may be looked upon as being still in its infancy. Portugal has not attained any higher degree, having even suffered its commerce of wine to be taken away from it. But should the inhabitants of these countries come to wake up from their lethargy, there may quite a revolution be effected in the commerce of wine not only in Europe but in almost all parts of the globe. * * * *

France is actually the country supplying at present all markets; its wines being most extensively spread. Remarkable, however, are the complaints expressed by nearly all patriotic Frenchmen at the dreadful neglect, especially in the southern provinces, of this branch of industry so important to that country. If France, according to Lenoir, is divided into four wine zones, running parallel with the equator, the first is south of 45 degrees; the second, between the 45th and 47th degrees; the third, between the 47th and 49th degrees; the fourth, north of the 49th degree. The average yield of these four zones was ascertained to be—

For the first zone	16	hectolitres,	80 litres to the hectare.
For the second zone	17	"	63 litres to the hectare.
For the third zone	29	"	9 litres to the hectare.
For the fourth zone	32	"	41 litres to the hectare.

The average price, six months after the vintage, was—

In the first zone	14 francs 16 centimes.
In the second zone	14 francs 00 centimes.
In the third zone	13 francs 13 centimes.
In the fourth zone	21 francs 54 centimes.

From which the superiority of the wine culture in the north over that of the south is easily seen. If the advantage in regard to yield and quantity is, according to these statements, already found to be in the northern districts, it is not less so in regard to quality, as will be seen from a merely superficial comparison of the various celebrated wines entering into commerce.

Dividing France through the 46th degree of latitude in two halves, the superior wines are thus distributed:

Southern half—red wines	55
white wines	36
Total	91
Northern half—red wines	79
white wines	58
Total	127

Though the extent of the vineyards cannot be accurately determined, yet the superiority of the north is again seen in the fact that among the southern vineyards those only of the department of Gironde are of a greater extent, while the others are very much scattered, embracing but very little land.

The superiority of the northern departments does, however, not exist in their position, but is merely the result of the greater industry of their inhabitants. While the wine growers of the south, on the whole, still follow the old fashion used to, combining bad cultivation with a defective preparation of wine, the very reverse is found in most of the northern sections. If in the south the wines entering into commerce have to be subjected to an additional treatment (travaille) in the seaports, especially in Bordeaux, Cette, and Marseilles, without which they could not endure a long transport on the sea, and which additional treatment is furthermore intended to correct those faults and defects, that through a better method of making wine could have been avoided from the beginning, the products of the north are the result of an intelligent and careful preparation of wine, in which there is no necessity for any forced treatment. In addition it might be asserted that most of the southern wines of France are not capable of being subjected to such a treatment; these wines, therefore, instead of becoming a source of wealth for those parts of the country, are merely employed for home consumption or for the manufacture of spirits of wine, in which way they can be made still available, in a measure, to commercial intercourse. The southern wine growers are too much prejudiced by the idea that they could leave everything to their favorable climate, and are from this reason excelled by their northern colleagues, whose industry is supplying the wants of their respective localities. The southerners had heretofore not much competition. But should such a competition grow up in the awakening of the industry of their Spanish neighbors, they must either make progress in their profession or succumb despite of their climatical advantages.

The wine culture in Germany, on the whole, has to struggle against still greater obstacles than the wine localities of northern France. Its seat is between the 48th and 52d degrees of north latitude, and it is only owing to German industry and perseverance that the grape-vine is cultivated even under the 53d degree. Though the Rhine wines are exported and celebrated all over the world, yet the other excellent vineyards are, on the whole, too inconsiderable, in consequence of the unfavorable climate, to gain a greater importance in the commerce of the world, its products being consumed in smaller circles. Experiments have often been made, and with the best success, in regard to the capability of the better class of German wines of bearing the transport by sea.

Though Germany, generally speaking, can never claim a very extended commerce of wine, on account of the comparatively small area of its better wine localities, its object should be to increase so much the home consumption, by improving its own wines, that the northern parts particularly could dispense of the foreign wines. Besides the improvement of the better products, it is necessary to grow a larger quantity of an inferior sort of good and cheap wines, similar to the lighter and cheaper wines of France. The communication between the northern and southern part of Germany being now greatly facilitated through the railroads, the French wines could, at least partially, be substituted by the lighter inferior wines of Germany. But this competition is still opposed by the unexampled cheapness of the former, and the small export by sea. In addition to this, there is a habit of long standing to the taste of the French wines, so that it will take considerable time until the French wines could be superseded by the German. Besides the disadvantage arising to the wine localities of Germany from a higher latitude, it is especially the unfavorable position, the injurious influence of which can only be obviated by the greatest attention and industry. The high range of mountains of the Jura, Switzerland, Tyrol, and Styria are directly situated towards south. North of these mountains there is a descent of the country, not being protected from any other mountains of a considerable height. The German wine localities are thus not only exposed to all storms and evils of northern climates more than other countries, but they are subjected from south to all injurious effects of high mountains, without being benefited by

their advantages. Besides, owing to the northern slope of the country, the effect produced by the rays of the sun being reflected is, at least, partially lost, this reflection contributing so much to the preference which vineyards south of high mountains enjoy over others. To this aspect, the frequent moisture, excessive in proportion to the heat of degree, and the frequent recurrence of wet summers, may be ascribed, because, during the prevalence of the winds from south and southwest, all watery dissolutions coming from the snow mountains and the cold air caused by them are carried north. There is only a portion of Tyrol, Carinthia, and Styria having the advantage of their high mountains sloping south; their aspect, however, differs so much from the other wine localities of Germany, and their wines produced are of such a different kind that, properly speaking, they do not belong any more to those known as German wines. They approach more to the Hungarian wines.

Among the countries of Europe provided with all natural riches, Hungary occupies the first position, though many of its resources of industry will, from a want of proper communications for a considerable time, be still excluded from the general intercourse. It is true there are a few railroads supplying this want in some parts of the country. Among the present resources of industry, wine culture seems to be one of the most important. Though situated almost under the same latitude as Germany, Hungary is protected from the north by the Carpathian mountains; it has an open aspect towards the south, and is so far remote from the ocean that its evaporations are either absorbed by the intermediate tracts of land or improved in a measure. These circumstances combine to make the aspect of Hungary superior to that of Germany, especially in regard to the period of maturity and its duration. Owing to its protected and favorable position, the month of October being often already cold and wet in Germany, and the disagreeable November are usually among the most agreeable and dryest months of the year. The period of maturity, which sets in earlier in the summer, on account of the warmer climate, is strikingly prolonged by the favorable dry weather in the fall, and the dry berries are thus produced, making the best wines in Hungary.

The wine culture in Hungary is distinguished particularly by the care with which the wine is manufactured. The object is to improve it by condensing the sugar present in the grapes; a method which has come down from the times of the Romans, and which has been retained free from admixture almost alone in this country. The method, also, of mixing the must with various herbs seems, likewise, to have been derived from the Romans. This method of making wine, however, had the effect upon the wine culture in Hungary that only juicy grapes with their skins were cultivated, which would, by bursting open, discharge their watery parts, changing into dry berries under the influence of the fine, dry weather in the fall, producing the best Hungarian wines. From Hungary it may be judged what wines may be expected from the Crimea, Bessarabia, and Greece, if this resource of industry should once be brought under a rational treatment in these countries.

Though the regions bordering on the east of the Mediterranean are looked upon as the cradle of the wine culture, from which the grape seems to have spread all over Europe, everything has remained in its former state, no improvement ever taking place during the long time the grape-vine has been under cultivation. By a greater activity the wine culture in these countries could be brought to the greatest perfection, all favorable circumstances being combined. The greatest obstacle is the indolence of the inhabitants and their religious fanaticism.

Of the wine culture in Italy we can only speak with regret. A few parts of the country excepted, it has sunk to the lowest degree.

Persia, which is considered by many as the starting point of the cultivation of the vine, produces wines celebrated all over the world, for instance, the

Schiras. The vineyards are irrigated once a year, in the spring, retaining moisture sufficient for the whole year.

Under the treatment, differing in so many countries under the different climatical influences, which the grape-vine since its introduction has experienced, under the various methods of its propagation in various localities and soils, a number of varieties of grapes must have been formed during the length of time, for the origin of which no account can be given. If the modes of cultivation from the time of their origin, had remained unchanged, though improving in the course of time, it might be easier to discover a certain succession in the development of the several varieties; but at the time of the migration of the nations, the different tribes changed their places of habitation, carried the varieties of their own grapes with them, and mixed them with those that were already planted, having been imported at the times of the Romans. Afterwards, when greater attention was paid to the different varieties, and when, perhaps, too much influence on the quality of the wine was attributed to them, they were transplanted from distant regions. Thus Charlemagne is said to have introduced, at an early time, the *Orleander* into the district of the Rhine, and the *Pinneau*, from the district of Milan, into France. Considering that more than fifty varieties were known to the Romans, and that the grape when transplanted from Asia Minor had not yet been subjected to the great changes of temperature which he had to meet when spreading over Germany, and considering also that the ancients had already acquired experience on the state of the grapes when transplanted in other localities, though the difference between these localities was a great deal smaller than that existing between the Italian and the German climate, it may be understood how much the nature of the grape must have been changed the more it advanced north or into Germany; the northern part of which, still inhabited by the aborigines, and not yet cleared, must have had a very injurious influence on its southern part. One of the main traits of change seems to consist in a diminution of the power of growth, transforming the grapes of originally large berries and strong wood into grapes of small berries and dwarfy growth. It may be that the usual property of grapes of small berries was already known at that time, namely, the property of an earlier maturity, and that such berries were especially employed for the purpose of extending the grape culture north. The ancients were in possession of so much knowledge on the nature of the grape that it is not at all improbable that they were guided by a certain method in extending the cultivation of the grape-vine. The correctness of the observation made by them, perhaps very early, on the better adaptation of smaller grapes to colder countries, is strikingly shown in the fact that especially in the northern wine countries all excellent varieties of grapes belong to the class having small berries, and that if a luxuriant growth is artificially forced, they will produce but an inferior wine like all grapes bearing berries of a naturally larger size.

The grape-vines were also mixed, in consequence of emigrations arising from various causes, and by order of several governments, with the view of improving their wine culture. French varieties were thus imported in Germany and Hungary, and the reverse. Later, several princes took a particular interest in wine culture, importing varieties of grapes from foreign countries in their own states. The Veltliner and Traminer are said to have thus been introduced in the southern parts of Germany. * * * * *

In the grapes, like in all plants, there is this difference between the varieties growing in northern and southern countries, that those of the south have a longer period of vegetation than those of the north. This fact has been brought in connexion with the nights becoming gradually longer in the south, and explained by the vegetation being consequently longer interrupted, inasmuch as this vegetation principally depends on the presence and action of the light upon the plants, and slower advances during the night than during the day. Though

this explanation is on the whole quite correct, still it must be presumed that it does not depend upon this cause alone, but generally upon a certain acclimation (habit, use) of the plant to a longer time of vegetation. If otherwise, the time of vegetation would, in a case of transplantation towards the north, necessarily change already in the first year through the influence of a longer sunshine; but this is not the case, inasmuch as southern grape-vines transplanted north, and northern grape-vines transplanted south, strictly retain their longer or shorter time of vegetation, respectively, changing the same only gradually by being cultivated for many years, and by their shoots (cuttings) being frequently replanted. The reason is more probable that certain varieties require a greater amount of heat than others to perfect their maturity, either in consequence of an inferior power of vegetation, requiring a stronger impulse from without, or the nature of the constituent parts of the grapes is such that they require a more considerable amount of heat to perfect their maturity.

For these reasons a rapid transplantation of grapes in greater distances, either north or south, is utterly impracticable, and never productive of any good results. If these removals are intended to succeed, they must only gradually be undertaken.

It is also a well-known fact that plants grown for a longer time under unfavorable circumstances are deteriorating and degenerating, and that they will in the same manner be improved by being grown in better positions. Inasmuch as the south is the original habitat of the grape, there is a deterioration in every advancement north. The correctness of this observation is sufficiently shown by comparing fruits of southern grapes with those grown in northern localities. Every approach from the north towards the south, on the contrary, is an improvement of the condition of the grape, and will always act beneficially, provided the change does not take place too suddenly. * * *

ON MANURING VINEYARDS.

We have already shown that the quality of manure which is to be applied is related to the climate. In our opinion the manure required by the various plants must be the more powerful and contain a greater amount of nitrogen in the same proportion in which these plants are transferred towards the north, thus changing their climatical relations assigned them by nature. While compost, marl, or green manuring are sufficient for the grape-vine in the south, (and there are many soils not even requiring these substances,) it can hardly thrive in the north without being supplied with a proper amount of cattle manure. Ammonia in this case seems to have a peculiar effect. Investigations instituted of late with the beets have shown that, even if there is no nitrogen contained in the sugar, its quantity present in the beet depends upon the amount of ammonia present in the manure, in the absence of which the amount of sugar in the beet is considerably lessened. It seems, therefore, that the presence of ammonia, even if there are no nitrogenous compounds formed, generally contribute to strengthen the vegetation of the plants, for which purpose its presence becomes more or less necessary.

The grape-vine presents almost the same case which is seen in the beet. It likewise requires no nitrogen, for the formation of its sugar being one of the most prominent of its constituent parts. Not even its leaves and shoots, though being filled with a considerable amount of acid substances, contain any or but a very small quantity of it, and yet they seem to grow vigorously only in the presence of nitrogenous manure. It seems, too, that the necessity for the application of ammonia increases in the same proportion in which other stimulants, light and heat, for instance, appear to have a weaker action for the development of vegetation. Led astray by the injurious consequences of too great an excess of nitrogenous manure, as well as by the opinion formerly entertained that the

plants require those substances merely of which they are composed themselves, we formerly were of the opinion that the application of nitrogenous manure to the grape-vine could be dispensed with. But now we have abandoned that view, and recognize the necessity of applying a certain amount of nitrogen for the promotion of the vegetative power of the vine, without, however, giving up the conviction that too great an amount of nitrogenous manure must at all events have an injurious effect upon the quality of the wine. It has become more and more evident during the course of the last years that, though the quantity of the substances necessary for the nourishment of the plants can be determined, regard must be had in manuring a field that the plants intended to be grown should always find a large portion of those substances most necessary for the formation of their own bodies and of such other component parts peculiar to their own kind. It is likewise known that it is not sufficient merely to procure these substances, but they must be either soluble in water or be capable of being gradually dissolved by additional chemical transformation. The same remarks are applicable to manuring grape-vines. * * *

The principal object in manuring a vineyard is to prevent its total exhaustion by continually supplying a sufficient quantity of the substances required by the vine. Again: it is known that meagre vineyards furnish a sweet and strong, though a thin and meagre, wine, wanting the so-called grease. It is also known that the gumous substance in the wine, from which this grease is formed, is generated by applying a good manuring; but to manure too strongly may make the wine too fat and smeary. It is not yet explained how the substances of the manure containing ammonia can produce too great an amount of nitrogenous parts. If in manuring attention must, therefore, be paid on the one hand to the preservation of the general vegetative power, the quality of the wine, on the other hand, must not be lost sight of by increasing the amount of ammonia too much.

In order to know which substances should be contained in the material used for manuring the grape-vine, it is necessary to know the principal constituent parts of the grape-vine itself. Besides the usual volatile substances, it is principally composed of lime, magnesia, alkali, and phosphoric acid. Lime and alkali may be applied, without any stable manure, in the shape of marl and wood ashes, which is advisable on soils containing no lime or alkali, for these substances are not sufficiently contained in the manure brought on the land. Magnesia and phosphoric acid, as well as other substances of less importance, are contained in the manure which is also to furnish the other necessary substances, inasmuch as they are not taken from the atmosphere. Should it be deemed advisable to apply a larger quantity of phosphoric acid, bone black should be employed, being a very powerful manure for grape-vines.

The general opinion, therefore, that the grape-vine in our climate (Germany) requires a regular application of manure is perfectly correct; those soils, however, containing neither lime nor alkali should receive the addition before mentioned. Sods, good earth, and similar materials, are often thrown into the vineyards. However good the application of such fertilizers may be, regard should be paid to the substances required by the soil of the vineyard.

In order to loosen the soil, materials are often put on, besides the manure, which, though not possessing a very great fertilizing action, make the soil loose, and promote the action of the atmosphere. Sawdust, clay mixed with rotten wood, tan, burned pomace, which still contains some alkali, and similar materials are advantageously employed.

Fresh straw manure is likewise adapted to loosen the soil. As it does in this condition not contain the material constituent parts in such a condensed form as is the case in well-rotten stable manure, a larger quantity of it must either be applied, or it must be made almost similar to rotten manure by putting it in layers as it comes fresh from the stable, covering each layer with earth, and pouring

dung water over it. The application of this method to vineyards is of very great advantage, because the carbonate of ammonia, otherwise volatile, is changed in non-volatile salts, acting neither too strongly nor at once, but gradually, without causing that injury which is often done to the grapes and the wine by the ammonia. The application of compost to the vineyards is often recommended, but to cover the dung place with earth secures the same advantages, and saves a great deal of labor.

It is generally thought that manure from horned cattle is best adapted to vineyards. The other kinds of manure contain too much ammonia, when fresh. If this is fixed, however, by being covered with earth, they can likewise advantageously be employed, their amount of dissolved mineral substances being increased, while they have been deprived of their injurious effect from the presence of too great an amount of volatile ammonia.

It being important, with regard to the quality of the wine, that too strong an action of the ammonia on the soil should be avoided, the best period for manuring vineyards is also indicated. This should be done in the fall, after gathering the grapes. There is plenty of time for the manure to decompose and to assimilate with the soil, and the dissolved salts can penetrate into the depth, which likewise deserves consideration, as the grape-vine has deep roots.

* * * * * * * * *

The following may be considered as the more important fertilizers employed in the cultivation of the vine:

I. *Cattle manure, mixed with litter.*—The animal excrements, without litter, seem less adapted to the vineyards, because they decompose too fast, either injuring the vine, or causing a great deal of the fertilizing substances to escape. The chemical action being greater in the vineyards, owing to their heat, than in other fields, it is desirable that there should be a slower process of decomposition, which is effected through the litter. The vine is supplied with a vigorous nourishment for a longer time, while its fruits are not filled with substances afterwards injuring the formation of the vine.

The following kinds of litter are particularly adapted to the preparation of the different kinds of manure employed in the cultivation of the vine:

1. The straw of the cereals, especially that of barley and oats, as containing the greatest amount of alkali, while there is no great difference in its fibre from that of other kind of straw.

2. Buckwheat straw, less adapted, owing to a smaller amount of alkali.

3. Straw of beans, especially useful, on account of its considerable amount of alkali, though the manure requires a much longer time to rot.

4. Straw of peas, vetches, and potatoes, is inferior in amount to the above.

5. Rape-straw is among the best litter, owing to its great amount of alkali.

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6. Broom, or heath broom; it must first be made mellow through heat. Its amount of alkali is not inconsiderable, and can therefore advantageously be used for green manuring. Ferns are likewise of a good effect when used as litter.

7. Sawdust, though varying according to the kinds of wood, supplies but little nourishment, but in heavy soils it acts beneficially in loosening it.

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With regard to the cultivation of the grape-vine, cattle manure ranks first. It does not decompose as rapidly as other kinds of manure; its action lasts, therefore, longer, without provoking a sudden growth. Among all animal excrements it contains the least quantity of nitrogen, and becomes, therefore, less injurious to the wine. As it contains but a small amount of alkali, it must be provided for by the selection of litter, if deemed necessary. The alkali might, however, be put on in some other way.

Horse and sheep manure, on account of their considerable amount of nitrogen, are injurious to the wine, and of little advantage to the grape-vine itself, as a

large portion of its constituent parts is not used by it. They can only be employed when entirely rotten, in which condition its application would comparatively prove too expensive, because, if applied to other purposes, all its constituent parts would operate on the plant, without permitting a part of it to escape. These manures, however, as shown elsewhere, may, by being covered with earth on the dunghill or in the sheepfold, be deprived of their injurious effect upon the cultivation of the vine, when they are not much inferior to the cattle manure.

Hog manure should be avoided, on account of the disagreeable taste it imparts to the wine. It can only be employed either in very small quantities, and mixed with other manures, or when entirely rotten.

The dung water consists of the urine gathered from the domestic animals and the fluid parts extracted by the rain from their solid excrements. Owing to its large amount of ammonia, it was formerly disliked as a manure to the grape-vine. But for several years we have been applying it with the best success, especially on poor and hot localities, where the various constituent parts are dissolved, probably through the amount of ammonia. Those places on which yellow vines have always been growing show none of them now, the fertility of the vines themselves having considerably increased, the grapes themselves no longer perishing, as was formerly the case. The precaution is, however, used of applying the dung water during the winter months. Experiments have, however, shown that it has no injurious effect when applied in summer, during a rain. From two to four quarts of it are brought into small ditches behind the vines, and covered with the earth that has been thrown out.

Dung water can also be advantageously used in the preparation of compost for the grape-vine.

Manure from poultry, especially from chickens and doves, already held by the Romans in high estimation as one of the most powerful fertilizers, is, from its amount of nitrogen, deemed less applicable to the cultivation of the vine.

Still less adapted are the human excrements, owing to their amount of nitrogen, even if no other reasons would prohibit its application to the vine.

Animal substances, wool, hair, claws, horn shavings, &c., are frequently used in the southern part of France as a fertilizer for the grape-vine. From their amount of nitrogen, however, they seem not very much adapted to it; besides, some of the essential elements are wanting. Dr. Liebig refers to a case in which a vineyard, at first very powerful and steadily manured with horn-shavings, suddenly deteriorated, because there had no alkali been contained in the horn-shavings, while vineyards receiving stable manure were kept in vigor for centuries by substituting the largest quantity of the various constituent parts.

Bones are well adapted from the presence of lime and alkali. There are wine countries in which there is a great demand for the bone black from the sugar refineries. France imports annually many thousands of quintals.

Oil-cakes dissolved in water are recommended by the French; see *Puvis*, des divers moyens de renouveler la Vigne, &c. It should be determined, however, whether a peculiar flavor is not imparted to the wine by the acrid substance inherent to the rape.

Pomace, crests of grapes—an excellent fertilizer for grapes, owing to their amount of alkali. * * * * As a large portion of the alkali is lixiviated by boiling, it is evident that fresh pomace only can have a full effect, while in the burnt pomace more of the constituent parts forming the future humus are retained. * * * * * * * *

Lime, being a component part of the grape-vine, must be present in every soil in which the vine is intended to grow vigorously. After its amount being consumed, a fresh supply is altogether necessary for the growth of the plant. This will grow but poorly on calcareous soils destitute of the other necessary admixtures.

In order to give a dressing of lime it is best to mix unslacked lime with mois-

earth and let it crumble. This mass is thinly scattered over the surface of the vineyard, in dry weather, without bringing the leaves in contact with it. Fields, which it is intended to grub up, may, in a similar manner, be supplied with calcareous earth.

There should no lime be applied in rainy weather, as it would be apt to form a mass of mortar. After the lime has been mixed with the earth, it is desirable to have a rain dissolving and gradually spreading it. Instead of unslacked lime any other calcareous earth may be applied.

Sand acts either mechanically, by separating or dividing the particles of earth, sticking closely together, being one of the most important means of improvements of heavy clay soils, or it acts actually as a fertilizer, inasmuch as its grains consist of substances which are applied when dissolved, as mica, feldspath, lime, &c. A soil deficient in these substances can easily be improved by the application of sand made from them. In other respects, too, the application of sand refreshes the soil, divides its parts, and will always have a favorable result. A similar effect is attributed to the application of earth, especially turf earth, which, besides its own constituent parts, contains also a considerable amount of substances for the formation of humus. The earth is the better, the more varied its own composition is as well as the soil which is intended to be improved. The fresher it is—that is, the less it has been improved for agricultural purposes and the cultivation of the vine, the better it is—good soil taken from the forest and mixed with the debris of granite being, perhaps, the most suitable of all. The earth of decomposed lava has also an excellent effect; its fertility being seen from the fact that localities having such soils require hardly any manuring. On the whole, such earths must always be applied containing those substances in which the soil to be improved is deficient.

Of ashes there are as many kinds as there is burning material. As they derive their fertilizing power only from the mineral salts contained in them, it is clear that their effect differs according to the plant and the soil to which they are applied. Some ashes contain alkali; others have none; and as it is probable that the great amount of alkali present in the grape-vine requires also a larger addition of it in the soil, those ashes only containing the greatest amount of alkali will have effect upon the vineyards; for instance, the wood ashes, especially those from the beach. It is hardly necessary to say, however, that they must not be cleared of their lye before being used.

In order to apply the ashes uniformly, they should be thoroughly mixed with the manure, or scattered over it when brought in ditches. To scatter them on the surface of the soil may not be found profitable, as they might be washed off sloping localities by the rain before being absorbed by the soil. In certain cases small quantities of potash may be scattered over the manure or in the ditches.

Soap ashes usually contain much lime of a caustic nature, and also some other mineral fertilizers in case wood ashes and kitchen salt have been employed in the manufacture. They act especially on such soils where carbonaceous humus and other organic remains exist, which are dissolved by these ashes.

Compost, if not mixed with substances obnoxious to the grape-vine, seems to be the most suitable fertilizer, because it is deprived of all volatile ammoniacal substances through the previous fermentation, its long exposure, and through its being stirred about, while the other substances are being so dissolved that they can easily be absorbed by the grape-vine. Lenoir suggests to make a sufficiently large pit in a shady place, not allowing the moisture to penetrate through its bottom. This pit should receive the various fertilizing substances, all animal and vegetable offal, turf, ashes, sod, etc.; they should be put in layers upon each other, and the whole covered with earth. In case the heap becomes too dry it should be moistened, so as to bring about a proper fermentation.

Donations to the Agricultural Division of the United States Patent Office, 1861.

Date.	Name of seeds, &c.	Name of donor.	Where from.	Amount.
1861.				
Jan'y 12	Mexican seeds	W. Schleiden	San Francisco, Cal	Several hundreds
17	Wild raspberry seed	S. M. Baird	Albuquerque, N. M	½ gill
23	Native Texas grape	Major H. C. Williams	Ays Hill	½ gallon seed, 100 cuttings
28	Box of apples of great size	M. Beaumont	Peterson, N. J	5 apples
Feb'y 1	Running grass	S. M. Baird	Albuquerque, N. M	
9	Black and white poppy seed	Ferd. Stoesser	Sheboygan, Wis	1 quart each
18	Hubbard squash seed	Charles Ketchum	Penn Yan, N. Y	1 pint
21	Grafts	Prof. J. C. Ketchum	Cleveland, Ohio	
March 1	Box of seed from Japan	Hon. T. Harris, (minister resident)	Yedo, Japan	Several papers
2	Cuttings of Scuppernong	U. V. Geoffray	Beaufort, N. C	
	Package of vegetable and flower seed	Prof. Theo. Bhure	New Windsor, Md	
	Seeds of Togan and red wood	A. S. Taylor	Santa Barbara, Cal	
	Early Peruvian potato	Joseph Mead	Leesburg, Va	6 tubers
6	Flower and other seeds	Francis Varga	Decatur, Iowa	30 varieties
	Vegetable and flower seed	Theo. Bhure	New Windsor, Md	39 do
12	Winter squash	do	do	2 pints
	Seven varieties of garden seed	Charles Ketchum	Penn Yan, N. Y	16 papers
13	Apple pie melon and Hubbard squash	Daniel Brown	Grafton, Ill	1 pint of each
12	Frijoles, from Cuba	P. N. Spoffard	New York	2 quarts
16	Transparent tomato seed	Dr. J. S. Parker	Ithaca, N. Y	1 gill
	Poppy seed	Julius Hielscher	Lexington, Minn	1 gill
18	Spelt seed	Charles Fosbender	Sparland, Ill	A few grains
14	Celery seed	Marcellus Heimhilger	New Bremen, N. Y	do
20	Winter pumpkin seed	D. A. Bulkley	Williamstown, Mass	2 quarts
25	Chinese sugar cane and Japan pea seed	H. Specht	Fredericksburg, Tex	1 quart C. S. cane, ½ pint peas
26	Wild goose rye	S. A. Foulk	Marysville, Cal	⅛ of a gill
28	Grape roots	G. R. Nebinger	Lewisburg, Pa	12 roots
	Box of sugar cane seed	C. A. Francke	Brookfield, Iowa	2 quarts
29	Mediterranean wheat	John Jones		1 quart
	Apple, pear, cherry, and plum cuttings	M. Beaumont	Peterson, N. J	
30	Seeds of squash, pumpkin, and melons	John Fleming	Readington, N. J	10 papers

April	1	Three kinds of native grape cuttings	William Murdoch	Ashville, N. C	12 cuttings
	3	Package of seeds	J. O. Hervey	Nicholasville, Ky	6 papers
	4	Grape cuttings	S. A. Foulk	Marysville, Cal	7 cuttings
		Grape cuttings	M. Keller	Los Angeles, Cal	4 bundles
		Box of madder seed	United States consul	Lyons, France	4 quarts
		Seeds		Cape Palmas, Africa	4 varieties
	15	Sugar from Chinese sugar cane	Hon. S. R. Curtis, M. C		2 samples
	16	Pumpkin and bean seed from Japan	William H. Shock	Baltimore, Md	A few seeds of each
	17	Variety of flower seeds	Mrs. Susan Drake	Brighton, N. Y	10 kinds
	19	Italian barley	Samuel Sutten	Prairie Du Sac, Wis	2 quarts
		Elder seed	Alex. Thunger	Sauk City, Wis	1 gill
	20	Einbohul, (single bean)	Dr. Fred. Hacker	Lebanon, Ill	1 gill
	24	Groundsell, or ague plant	William Murdock	Ashville, N. C.	4 gills
	27	Wax beans, (black)	F. Hacker	New Holstein, Wis	3 seeds
		Sugar asparagus	William Arnd	Olean, N. Y	½ gill
May	3	Rhubarb seed	S. J. Wyndham	Murfreesboro, N. C	½ gill
	7	California gigantea seed	Rev. Robert Keller	California	A few seeds
	9	Evergreen corn	William C. Best	Lane's Prairie, Ill	
	11	Pericarp of a species of cactus, (prickly pear)	S. M. Baird	Albuquerque, N. M	
June	8	Rosin plant	Hoben Holden	East Genoa, N. Y	
July	29	Australian plants	W. C. Hampton	Mt. Victory, Ohio	36 varieties
		American seeds	do	do	do
		European seeds	do	do	do
	30	Cheah seed	Alex. Taylor	Santa Barbara, Cal	
Aug.	3	Tree cotton seed	William Trevitt	Callao, S. A	
	24	Wild raspberry seed	O. H. Kelly	Itasca, Wis	1 quart
		Common wheat	Francis Varga	Hungary, Europe	
Oct.	5	Wild cotton seed	Calvin Blair	Levering, Ohio	
Sept.	30	Wild beans found in the woods	Henry Reynolds	East Wilton, Me	
Oct.	11	Premium wheat seed	Samuel Ringwall	Downington, Pa	
	14	Wild flaxseed	Alex. S. Taylor	Santa Barbara, Cal	
	24	Mountain seedling	William Bacon	Richmond, Mass	
	26	Red huckleberry seed	Benj. Dolbear	Steilacoom, Wash. Ter	
		White Turkey wheat	John H. Kliggart	Columbus, Ohio	
	5	Wild goose rye	S. A. Foulk	Marysville, Cal	
Nov.	12	Scions of the African oak, (Guercus?)	G. H. Bute	Nazareth, Pa	
		Rabiniu befoniana	do	do	
		Cuttings of Salix laurifolia, (shade tree)	do	do	
		Cuttings of pearl grape	do	do	

Donations to the Agricultural Division of the United States Patent Office, 1861.—Continued.

Date.	Name of seeds, &c.	Name of donor.	Where from.	Amount.
1861.				
Nov. 12	Cuttings of Arramont grape	G. H. Bute	Nazareth, Pa	
	Cuttings of Lombardy grape	do	do	
	Cuttings of Hars Levetii or Linden hopec grape	do	do	
	Cuttings of Furmint grape	do	do	
	Cuttings of Riesling grape, (direct from the Rhine)	do	do	
	Green grape	do	do	
	Spiræa colusa	do	do	
30	Cupressus distichum	W. C. Hampton	Mt. Victory, Ohio	
	Apia puisapo	do	do	
	Pinus maritima	do	do	
	Cupressus thyoides	do	do	
	Colutea arborescens	do	do	
	Pendila japonica	do	do	
	Abies excelsia	do	do	
	Fraxinus ornus pendula	do	do	
	Pinus prunilia	do	do	
	Arbutus muredo	do	do	
	Saxus beccata	do	do	
	Abies picta vel Sibarica	do	do	
	Fagus sylvatica	do	do	
	Pear seed	do	do	
	African cotton seed	James L. Smith	Washington, D. C	1 ounce
Jan'y 30	Sea Island cotton seed and cotton	S. Dorethius	Newport, R. I	
29	Creole beans	C. J. Albright	Cambridge, Ohio	
Feb'y 6	Pomegranate seed	E. B. Bartlett	Palermo, N. Y	3 pints
Jan'y 27	Russian maize	D. J. M. A. Jewitt	Marblehead, Mass	½ dozen
	Variety of winter apples	William B. West, (consul)	Galway, Ireland	1 gill
		John S. Bogan	Jefferson county, Ill	

AGRICULTURAL INVENTIONS OR DISCOVERIES,

FOR THE YEAR 1861.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Bee-hives	S. R. Bryant	Waterford, Pa.	February 12
Butter-worker	Josiah A. Allen	Deerfield, Mass.	February 12
Bee-hives	N. D. Hartley and M. S. Morehouse.	Quincy, Ill.	February 12
Bee-hives	Josiah C. Gray	Frankfort, Ind.	February 19
Bee-hives	R. Daniels and G. P. Cobb	Woodstock, Vt.	March 12
Bee-hives	Elsberry L. Jinnett		March 19
Butter-worker	P. G. Woodward	Waterford, Pa.	March 19
Bee-hives	Orlando Miller	Girard, Pa.	April 2
Bee-hives	Samuel Ide	East Shelby, N. Y.	April 2
Bee-hives	Alexander Clow, assignor to self and S. H. Campbell.	Waterford, Pa.	April 16
Bee-hives	Hugh H. Whitney	Waterford, Pa.	April 30
Bee-hives	F. R. Walker	Waterford, Pa.	May 7
Bee-hives	Triphena P. Hornbrook	Wheeling, Va.	May 21
Bees, Device for hiving	Calvin Cutler	Tonawanda, N. Y.	May 21
Bee-hives	Oliver Reynolds	Webster, N. Y.	June 4
Bee-hives	Ransom Bullard	Litchfield, Mich.	June 4
Butter-workers	George M. Roads	Hamilton, N. Y.	July 2
Bee-hives	George R. Hartman	Fort Wayne, Ind.	July 9
Bee-hives	Martin Metcalf	Grand Rapids, Mich.	July 30
Bee-hive	Ferdinand Woodward	Sacramento City, Cal.	August 13
Bag-holder	A. M. Olds	Glenmont, Wis.	August 20
Bee-hives	David Dougal and William Truxall.	Butler, Pa.	September 3
Bags while being filled, Machine for holding.	John H. Morris	Niles, Mich.	September 3
Butter-workers	Noah Bennett	Sherman, N. Y.	September 17
Bee-hives, Moth traps for	Rufus Haven	Perrysville, Ind.	September 24
Bee-hives	Jeremiah Rohrer	Middletown, Pa.	October 8
Bee-hives	M. M. Lee	Rosindale, Wis.	October 15
Bee-hives	D. M. Gunn and C. L. Cain	Oskaloosa, Iowa.	October 15
Bee-hives	A. J. Smith	Decorah, Iowa.	October 15
Bee-hives	Melancthon Stillwell	Manlius, N. Y.	October 22
Bee-hives	Henry R. Terry	Edenboro', Pa.	November 5
Bee-hives, Moth traps for	William J. Hazen	Bethany, Pa.	November 12
Butter-worker	Buel D. Pease	Madison, Pa.	November 26
Bee-hives	Richard Colvin	Baltimore, Md.	December 3
Bee-hives	Edwin Corner	Columbus, Ohio	December 24
Cultivators	J. T. D. Alexander	Maryenna, Texas	January 15
Cultivators	Daniel S. Stafford	Decatur, Ill.	January 15
Cultivators	W. H. Smith	Wyanet, Ill.	January 15
Cultivators	W. A. Dryden	Monmouth, Ill.	January 15
Cultivators, Seeding	J. Goodman and Samuel Rote.	Lancaster, Pa.	January 15
Cotton-scrapers	J. D. Houston	Pope's Depot, Miss.	January 15
Corn-shellers	C. C. French	West Stockbridge, Mass.	January 15
Cultivators	E. W. Fuller	Martinsville, La.	January 22
Cultivators	Andrew B. Lefler	Canton, Ind.	January 22
Churn	J. V. Stevens	Pomeroy, Ohio.	February 5
Cultivators	Solomon Dwight	Byron, Ill.	February 5

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Churn	M. C. Longacre, assignor to self and R. R. Herrick.	Cleveland, Ohio	February 5
Cultivators	Charles Beach and Thomas Brown.	Jacksontown, Ohio	February 12
Cultivators	Silas M. Goff	East Addison, Vt.	February 12
Cultivators	R. A. Leeper and Z. B. Kidder.	San José, Ill.	February 12
Churn	V. Stirewatt	Albany, Ga.	February 12
Cultivators	J. W. Taylor.	Ashland, Va.	February 12
Cultivators	Whitman Price	Mount Olive, N. C.	February 12
Cheese-vats, Heater for	Howell Cooper	Watertown, N. Y.	February 12
Clover seed, &c., Machines for separating.	Henry Hunsucker	Lewisburg, Pa.	February 12
Clover seed, Machines for hulling and cleaning.	David S. Wagener	Pen Yan, N. Y.	February 12
Cotton and cornstalks, Machines for extracting.	Josiah Bishop	Austin, Texas	February 19
Churn	Peter Dunwald	Corning, N. Y.	February 19
Cotton-scrapers	Josiah Shepard	Columbia, Texas	February 19
Churn	John R. Mickey	Waterford, Pa.	February 26
Cultivators, Rotary	Cicero Comstock	Milwaukie, Wis.	February 26
Cultivators, Seeding	Campbell T. Settle	San José, Cal.	February 26
Cotton-pickers	John Griffin	Louisville, Ky.	March 5
Corn-huskers	George R. Walker	Washington, D. C.	March 5
Cultivators	J. B. Turner	Jacksonville, Ill.	March 12
Cultivators	C. W. S. Heaton	Salem, Ill.	March 12
Cultivators	William Strieby	Wagontown, Pa.	March 12
Churn-dasher	Moses D. Wells	Morgantown, Va.	March 19
Churn	William Hamilton	St. Catharine, Mo.	March 19
Cultivators	Charles Gardner	Hoosick, N. Y.	March 19
Cultivators	Frederick Stamm	Lancaster, Pa.	March 19
Cultivators	John Cox and John A. Throp.	Three Rivers, Mich.	March 19
Cultivators	John Markel	Monticello, Ill.	March 19
Cultivators	W. F. Quinby	Stanton, Del.	March 19
Cultivators	William S. Riggs	Hightown, N. J.	March 19
Corn-shellers	Matthew Trimble	Princeton, Ill.	March 26
Churn	William Bently Hopkins	Oakfield, N. Y.	March 26
Cheese-vat operator	C. M. Wilkins	West Andover	April 2
Cornstalks standing, Machine for cutting.	T. J. Freeman, assignor to self and E. T. Freeman.	Hayworth, Ill.	April 2
Cultivators	O. W. Goslee	Bowling Green, Ohio	April 2
Cultivators	William F. Veber		April 2
Cultivators	James A. Spear, assignor to William J. Kane.	Manchester, Pa.	April 9
Cultivators, Cotton	George W. Rice	Demopolis, Ala.	April 16
Cultivator-teeth	William Morrison	Chadd's Ford, Pa.	April 16
Cultivators	Isaac Stout	Fremont, Ill.	April 16
Cultivators	Chauncey W. Emerson	Albany, New York	April 23
Cheese-vat	Darius W. Maples	Homer, New York	April 30
Churn	William Jackson and J. Clarke.	Syracuse, N. Y.	May 7
Corn-shellers	L. S. Bundy and L. F. Edgerton.	Hyde Park, Vt.	May 14
Cultivators	Ira Cooper	Saybrook, Ohio	May 14
Churn	John Stilwell	Griffin, Ga.	May 21
Cultivators	Joseph Vowles	New Hudson, Mich.	May 21
Cultivators	George W. Hildreth	Lockport, N. Y.	May 21

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Cultivators	Josiah Mumford and J. W. Wilson.	Clarksburg, Ohio	May 28
Cultivators	T. S. Cone and H. S. Potter	Oneida, Ill.	May 28
Cultivators	William S. Wier, jr.	Monmouth, Ill.	May 28
Cultivators	Richard F. Joynes	Bristol, R. I.	June 4
Clover-seed, Machines for hulling and cleaning.	Francis E. Cook	Guilford, Ohio	June 4
Cultivators	Shugar M. Cain and William Stelfox.	Austin, Texas	June 4
Cultivators	H. L. Baldwin	Branford, Conn	June 11
Cultivators	Joseph and St. Clair Gum	Marseilles, Ill.	June 18
Cultivators	John Keezer	Chilicothe, Ohio	June 18
Churn	Charles T. Anderson	Hyattstown, Md.	June 18
Churn	Thomas A. Jebb	Buffalo, N. Y.	July 2
Cultivators	L. H. Doyle	Waterloo, Iowa	July 9
Churns	W. F. Armstrong and Morgan Payne.	Cardington, Ohio	July 16
Churns	C. D. Van Allen	Syracuse, N. Y.	July 23
Churns	H. Hagens	Brandonville, Va.	July 23
Cultivators	Nathan Carr, jr., and John Carr.	Monmouth, Ill.	July 23
Corn-shellers and huskers	M. F. Williamson and J. J. Swigert.	Hyattsville, Ohio	July 23
Corn-shelling and grind'g, Machines for	George Seymour	Cedar Rapids, Iowa	July 23
Churns	John Fowler and W. L. Walter.	Homer, N. Y.	July 30
Cutters, feed, Adjustable knife of	John R. Whittemore	Chicopee Falls, Mass.	July 30
Corn-shellers	Augustus Adams	Sandwich, Ill.	August 6
Cultivators	G. W. Lawbaugh and John Williams.	Shanesville, Ohio	August 13
Churn	M. C. Cronk	Auburn, N. Y.	August 13
Corn-shellers	Jacob B. Rand and W. A. H. Long.	Fisherville, N. H.	August 13
Churn	Nelson Gabel	Gratis, Ohio	August 20
Churns	Thos. R. Markillie	Winchester, Ill.	August 27
Churns	David M. Seeley	Albany, N. Y.	August 27
Cultivators	Henry Bowers	New Hudson, Mich.	August 27
Cutters, Feed	Matthew Fletcher	Louisville, Ky.	August 27
Cultivators	Wade H. Haworth	Tonawanda, Ill.	August 27
Churn	Robert Parker	North Cohocton, N. Y.	September 3
Cultivators	J. B. Morehead and J. A. & G. G. Pool.	Bellefontaine, Ohio	September 3
Cultivators	Riley Brotton	Oskaloosa, Iowa	September 10
Churn	S. W. Mudge	Rome, N. Y.	September 10
Churns, Mode of operating	Isaiah M. Williams, assignor to self and Wm. P. Wolf.	Blanchester, Ohio	October 1
Corn-shellers	Samuel McQuiston	Morris, Ill.	October 8
Churns	James H. Doughty	Adamsville, Ohio	October 8
Seed-furrows, Device for making	George G. Crose	Schoolcraft, Mich.	October 15
Clover-stripper and Hay-rake, Combined.	R. H. Blair and A. W. Beatty.	Saltsburg, Pa.	October 22
Clod-crusher	Charles Mahan, sr., assignor to self and Alfred Johnson.	Jamestown, Ohio	October 29
Corn-shellers	Ancil Stickney, assignor to self and Wm. H. Hovey.	Concord, N. H.	October 29

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Churn	S. W. Mudge	Rome, N. Y.	November 5
Corn-shellers	Abram H. Jones	Fallsington, Pa.	November 5
Cultivators, Spring tooth for	Henry Francisco	Whitewater, Wis.	November 5
Cultivators	A. Hoffman and H. W. Limebeck.	Half-Day, Ill.	November 19
Churns	Henry Sidle	Dillsburg, Pa.	November 26
Churn	Royal H. Peck, assignor to self and E. M. Gifford.	Wolcott, Vt.	November 26
Cattle-fastenings	Kendall Gibbs	Berwick, Maine	November 26
Cultivators	J. B. Turner	Jacksonville, Ill.	December 3
Currycombs	Robert D. Porter	Zanesville, Ohio	December 10
Churns	Geo. Goeway, assignor to self and E. S. Marsh.	New York, N. Y.	December 17
Corn, Machines for removing the husks from.	Jos. Young, assignor to John B. and Joseph Young.	Varick, N. Y.	December 24
Cultivators	Jeremiah Fink	Baldwinsville, N. Y.	December 24
Cultivators	D. C. Gilliland	Brownsville, Ohio	December 24
Corn-shellers	Simon J. Parmele	Killingworth, Conn.	December 24
Drills, Seed	J. H. Bean	Foreston, Ill.	January 15
Drills, Seed	Hiram Moore	Brandon, Wis.	March 26
Drills, Seed	Geo. W. Neville	Bath, Ill.	April 16
Drills, Seed	Jacob Strager	Miamiburg, Ohio	May 14
Drills, Seed	James S. Marsh	Lewisburg, Pa.	May 14
Drills, Seed	John and Samuel Fahrney	Washington co., Md.	June 18
Drills, Grain	H. A. and L. B. Myers	Elsmore, Ohio	June 25
Drills, Seed	John Sims	Boston Corners, N. Y.	July 9
Drills, Seed	W. D. Harrah, B. S. Baldwin, and H. P. Jones.	Davenport, Iowa	August 27
Fertilizers, Machines for sowing	John F. Keller	Greencastle, Pa	January 8
Fruit gatherer	Leonard M. Parker	Shirley Village, Mass.	February 19
Fruit gatherer	Marcus L. Byra and George Clark.	New York, N. Y.	February 26
Fruit gatherer	Norman H. Bruce	Shirley, Mass	August 6
Feed-bag for horses and other animals.	R. B. Fitts, assignor to self, O. P. Thornburg, and Wm. Stacey.	Philadelphia, Pa.	September 17
Fruit-gatherers	Mark Lounsbury	Seymour, Conn	December 3
Fertilizers	St. John O'Dorris	Philadelphia, Pa.	December 24
Grain, Machines for binding	Stephen Reynolds	Richmond, R. I.	February 12
Guano-spreaders	J. J. Saunders	Sparta, Ga.	February 12
Grain-binding machine	W. W. Burson	Yates City, Ill	February 26
Grain-cradles	Daniel H. Viall	Schaghticoke, N. Y.	April 30
Grains, Machine for scouring, cleaning, and smutting rice, coffee, and other.	L. D. Hawkins, assignor to Alfred Peabody.	San Francisco, Cal.	August 13
Grain, Machines for elevating	John and Henry Bruckshaw and Wm. Scott Underhill.	England	November 5
Grain-cleaners	Lewis and Jacob Miller	Canton, Ohio	December 17
Harvesters	Dayton S. Morgan	Brockport, N. Y.	January 22
Harvesters	George Esterly	Whitewater, Wis.	January 22
Harvesters	George Esterly	Whitewater, Wis.	January 22
Hay, Machine for gathering	F. F. Fowler	Crane Township, Ohio.	January 22
Harvesters, Finger-guards for	M. L. Bullard	Canton, Ohio	January 29
Harvesters, Finger-guards for	M. L. Bullard	Canton, Ohio	January 29

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Harvesters, Finger-guards for	M. L. Bullard	Canton, Ohio	January 29
Harvesters, Finger-guards for	M. L. Bullard	Canton, Ohio	January 29
Harvesters	Charles G. Dickinson	Poughkeepsie, N. Y	January 29
Harvesting-machines	Elisha H. Wheeler	Keokuk, Iowa	January 29
Harvesters, Making finger-guards for	Lewis Miller	Canton, Ohio	January 29
Harvesters	J. B. Tinker	Plymouth, N. Y	February 5
Harrows, Rotary	Levi S. Tyler	Linesville, Pa	February 5
Harvesters, Rakes for	Thomas S. Whitenack	Easton, Pa	February 5
Harvesters, Cane	W. B. Robertson	West Baton Rouge, La.	February 12
Harvesting-machines	Rufus Dutton	Dayton, Ohio	February 12
Harvesters	P. H. Standish	Pacheco, Cal	February 19
Hay, Machines for loading	John B. McIntosh	Gerard, Pa	February 19
Harvesters	J. Bartlett Smith	Winfield, N. Y	February 19
Hay, raking and cocking, Machines for	L. R. Stone	Owassa, Mich	February 26
Harvesters, Binding attachment to	L. P. Harris	Mansfield, Ohio	February 26
Harvesters, Binding attachment to	Clark Alvord	Westford, Wis.	March 5
Hogs from rooting, Device to prevent	R. Little	Middle Branch, Ohio	March 5
Harrows	Samuel Miller	Winchester, Ohio	March 19
Harvesters, Fingers for	E. P. Russell	Manlius, N. Y	March 19
Harvesters	John Blue	Covert, N. Y	March 26
Harrows, Rotary	William H. Main	Liverpool, Ohio	March 26
Harvesters, Cutting apparatus of	Daniel H. Thayer, assignor to self and Stephen A. Baker.	Lansing, N. Y	March 26
Harrow-frames	J. Brainerd, and E. F. and A. W. Olds.	Cleveland, &c	April 2
Harvesters, Raking attachments to	George E. Chenoweth	Baltimore, Md	April 9
Harvesters	Adam Pritz	Dayton, Ohio	April 16
Harvesters, Rake for	Chester Bullock, assignor to self and De Forest Weld.	Jamestown, N. Y	April 23
Harvesting-machines	T. C. Hargraves, assignor to H. M. Crane.	Schenectaday, N. Y	April 30
Harvesting-machines	Frederick H. Manny	Rockport, Ill	April 30
Harvesting-machines	Thomas S. Whitenack	Easton, Pa	April 30
Harvesters, Rakes for	James Pine, assignor to self and J. J. Veile.	Troy, N. Y	May 7
Harvesters	James Pine, assignor to self and J. J. Veile.	Troy, N. Y	May 7
Honey-comb, Artificial	Samuel Wagner	York, Pa	May 7
Harvesters, Raking attachment to	A. B. Smith	Clinton, Pa	May 14
Harvesters	Ira Jewell, assignor to David M. Osborne.	Wheaton, Ill	May 21
Harvesters	James S. Marsh	Lewisburg, Pa	May 21
Hay, Machines for turning and spreading.	E. W. Bullard	Barre, Mass.	May 21
Harvesters, Clover	Frederick Decker	Ostrander, Ohio	May 28
Harvesters	Frederick Landon, assignor to B. E Huntley, Jno. M. Bowman, and Charles Fayette Stillman.	Brockport, N. Y	May 28
Harvester	Charles P. Wing	Fayetteville, N. Y.	May 28
Harrows	Moses Bucklin	Grafton, N. H	June 4
Harvesters, Rakes for	W. S. Wilmot	New York, N. Y	June 4
Hominy-machines	David Haines	Union Bridge, Md	June 11

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Harvesting machines	Franklin Clark, assignor to self and N. Coones.	Charlotte, N. Y	June 18
Harvesters	Robert Brown	Frederick, Md	June 18
Harrows	John T. Foster	Jersey City, N. J	June 18
Harrows	T. C. Hooker	Kendall, N. Y.	June 18
Hulling and cleaning clover-seed, Machines for.	Jacob Kuhn	Centreville, Pa	June 25
Harvesters	Geo. W. Richardson, assignor to self and Robt. Glover.	Grayville, Ill	June 25
Harvesters	Wm. K. Miller	Canton, Ohio	July 2
Harvesters, Clover	David Hinkle	New Pittsburg, Ohio	July 2
Harvesting-machines	Wm. A. Kirby, assignor to self and David M. Osborne.	Buffalo, N. Y	July 2
Harvesters	McClintock Young, jr.	Frederick, Md	July 9
Harvesters	John Q. A. Frazier.	Piqua, Ohio	July 16
Harvesters	Geo. S. Reynolds, assignor to self, James Brown, and J. W. Whitney.	Tunbridge, Vt	July 23
Hay, Machines for raking and loading.	M. G. Couch	Odessa, N. Y	July 23
Hoes	Philip and Henry E. Craps	Bridgewater, Mass.	August 6
Harvesters, Corn	Isaac V. Brower	Millstone, N. J	August 13
Hullers, Buckwheat	Chase B. Horton	Elmira, N. Y	August 13
Harvesters	John Woody	Mount Vernon, Ind	August 20
Harvesters, Corn	S. H. Hamilton	Macomb, Ill	August 27
Harvesting-machines	J. M. Orput	Malta, Ill	August 27
Hop-frames	Levi A. Beardsley	South Edmeston, N. Y.	September 3
Harvesters, Corn and Cane	Wm. M. Mason	Pole, Ill	September 3
Harvesters, Rotary	Alonzo M. Olds	Green Oak, Mich	September 3
Harvesters	Worden P. Penn.	Belleville, Ill	September 10
Harvesters, Guard-fingers for	K. H. C. Preston	Manlius, N. Y.	September 10
Hay-elevating forks	Levi A. Beardsley	South Edmeston, N. Y.	September 17
Hay, Machines for loading	L. Misbler	Mogadore, Ohio	September 24
Harrows	John Adams	Monroe, Mich	September 24
Husking-pins	William Sherwin	Shelburn Falls, Mass	September 24
Harrows and sowers	James Brewer	Albany, Ill	October 1
Harvesters, Automatic rakes for	Theodore F. Kuhns, assignor to Mary Manny.	Rockford, Ill	October 1
Harvesters, Automatic rakes for	Theodore F. Kuhns, assignor to Mary Manny.	Rockford, Ill	October 1
Harvesters, Automatic rakes for	Theodore F. Kuhns, assignor to Mary Manny.	Rockford, Ill	October 1
Harvesters	John F. Seiberling	Doylestown, Ohio	October 15
Harvesters	James Pine, assignor to self and J. J. Viele.	Troy, N. Y	October 22
Harvesters	William McIntosh	Wilmington, Ill	October 22
Harvesting-machines	William Neff.	Centre Hall, Pa	October 22
Harvesters, Binding attachment to	Chas. Powers and P. Lancaster.	Bronson, Mich	October 29
Harvesters, Rakes for	A. R. Reese, William Gould, and Nelson Lake.	Phillipsburg, N. J	November 5
Harvesters, Grain and Grass	O. Billings	La Grange, Ohio	November 12
Harvesters, Reels for	E. P. Russull	Manlius, N. Y	November 12
Harvesters	E. P. Russull	Manlius, N. Y	November 12
Harvesters, Rakes for	Walter A. Wood.	Hoosick Falls, N. Y.	November 19
Harvesting-machines	J. C. and C. N. Mayberry	White Rock, Ill	November 19

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Harvesters	W. A. Wood	Hoosick Falls, N. Y.	December 3
Harvesting-machines	Lewis Miller	Canton, Ohio	December 3
Harvesters, Grain and grass	Lewis Miller	Canton, Ohio	December 10
Harvesters	Daniel Emerson, assignor to Mary Manny.	Rockford, Ill.	December 10
Harvesters	Harvey L. Hopkins	Lebanon, N. Y.	December 17
Harvesters, Cutting-apparatus of	T. C. Hargraves	Schenectady, N. Y.	December 17
Harvesters, Cutting-apparatus of	A. Stoeler and S. A. Sisson	Bristol, Pa.	December 17
Harvesters	K. H. C. Preston, assignor to E. P. Russell.	Manlius, N. Y.	December 17
Harvesters	Wm. Van Auden	Poughkeepsie, N. Y	December 24
Harvesters	E. P. Russell	Manlius, N. Y.	December 24
Harvesters, Cutting-apparatus for	L. G. Kniffen	Worcester, Mass.	December 24
Harrows, Rotary	Alonzo W. Olds	Green Oak, Mich	December 24
Harvesters	Geo. S Knapp	Dubuque, Iowa	December 24
Mills, Cider	Henry F. Watkins	Anderson, Ind.	February 5
Mowing-machines	Thos. H. Dodge	Washington, D. C.	February 19
Mowing-machines	Edwin R. Pease, assignor to Richard P. Pease.	Poughkeepsie, N. Y.	March 12
Mowing-machines	Geo. W. Jennings	Boston, Mass.	March 12
Mowing-machines	Rufus Dutton	Dayton, Ohio	March 19
Mills, Sugar	Martin Roe	Townsend, Ohio.	March 26
Mowing-machines	John H Rible	Dayton, Ohio	April 2
Mowing-machines	E. F. and J. Herrington	West Hoosick, N. Y.	April 9
Mills, Cider	Samuel and R. W. Caldwell	Chilicothe, Ohio.	April 16
Mowing-machines	Henry Fisher	Alliance, Ohio	May 7
Milking Cows, Device for	William D. Nichols	Davenport, Iowa	May 21
Milking Cows, Apparatus for	M. L. Baker	Milford, N. Y.	May 21
Mowing-machines	Jno. De L. Watkins and R. Bryson.	Schenectady, N. Y.	July 23
Mills, Cider	Jacob Diehl and Wm. Wilson.	Brooklyn, Ohio	August 6
Manger, Portable	Thomas Fisler	Camden, N. J.	September 10
Mowing-machines	Asa L. Darby	White Creek, N. Y.	September 17
Mowing-machines, Hand	L. M. Doudna	Amherst, N. H.	October 29
Mills, Cider and Wine	J. R. Gates	Louisville, Ky.	October 29
Mowing and Reaping-machines, Cutting-apparatus of.	Cyrus H. McCormick	Chicago, Ill.	November 5
Mowing-machines	L. G. Kniffen	Worcester, Mass.	December 17
Ploughs	Gilbert H. Moore	Rochester, N. Y.	January 1
Planters, Corn	A. W. Brinkerhoff	Upper Sandusky, Ohio.	January 8
Planters, Corn	William Combs	Duquoin, Ill.	January 8
Planters, Corn	E. W. Kimball	Ottawa, Ill.	January 8
Ploughs	Lorenz Wolf	Hamburg, Mo.	January 15
Planters, Cotton-seed	Lewis B. Brown	Black Creek, Ga.	January 15
Ploughs, Subsoil	Joshua F. Cameron	Livingston county, Mo.	January 15
Ploughs, Devices for securing shields to	Joshua F. Cameron	Bedford, Mo.	January 15
Planters, Cotton-seed	Daniel Herlong	Sandy Ridge, Ala.	January 15
Plough, Seeding	Worden P. Penn	Belleville, Ill.	January 15
Ploughs, Covering	Washigton Roberts	Rocheport, Mo.	January 15
Planters, Corn	J. Y. D. Murphy	Half Moon, Pa.	January 22
Ploughs	William Jarrell	Trenton, Tenn.	January 22
Ploughs	Jeremiah Sweitzer	Mishawaka, Ind.	January 22
Planters, Corn	Wm. C. Willey	Princeton, Ill.	January 22
Pickers, Cotton	John Griffin	Louisville, Ky.	January 22

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Potatoes, Machines for digging	DeWitt Clint and Ives Lynd	Poestenkill, N. Y	February 5
Ploughs, Gauges for constructing the mould-boards of.	Ebenezer Vaughn, by J. B. Vaughan, administrator.	Marion, N. Y	February 5
Planters, Seed	Stephen Johnson, assignor to self and Lyman E. Damon.	Cold Spring, N. Y	February 5
Planters, Seed	C. C. Garrett	Spring Hill, Ala	February 12
Ploughs	Henry D. Rogers	Grafton, Ohio	February 12
Planters, Corn	Lansing K. Jenne, assignor to self and Wm. Ashley.	Grand Rapids, Mich	February 12
Ploughs	Gabriel Utley	Chapel Hill, N. C	February 12
Ploughs	Joseph K. Gingrich	North Annville, Pa	February 19
Planters, Corn	Benjamin H. Elmore	Richmond, Ind	February 19
Ploughs	Geo. and John Seibert	Ashley, Ill	February 26
Ploughs	Daniel H. Maloy	Temperance, Ga	February 26
Ploughs	Wm. F. Shedd	Ripley, Ohio	February 26
Ploughs	J. M. Rodman	South Union, Ky	February 26
Planters, Corn	F. B. Preston, assignor to self and W. H. Stapleton.	Fayette, Mo	February 26
Potato-diggers	T. C. Zulick	Schuylkill Haven, Pa	March 5
Ploughs	J. Rulofson and D. De Garmo	Rochester, N. Y	March 12
Ploughs	George A. Walker	Annville, Pa	March 12
Ploughs	Lyman D. Burch	Sherburne, N. Y	March 12
Ploughs	Daniel W. Smith	Dooly county, Ga	March 19
Ploughs	Laure Green	Great Bend, Pa	March 19
Ploughs	George W. Depew, assignor to Horton Depew & Son.	Peekskill, N. Y	March 19
Planters, Corn	John Cooley	Tafton, Wis	March 19
Ploughs	John A. Parlett and Jeremiah Thompson.	Elmira, N. Y	April 2
Ploughing and tilling land by steam, Machinery for.	John Fowler, jr., assignor to Wm. Penn Tatham.	Leeds, England	*April 9
Ploughing and tilling land, Machinery for.	John Fowler, jr., assignor to Wm. Penn Tatham.	Leeds, England	*April 9
Ploughing and tilling land by steam, Machinery for.	John Fowler, jr., assignor to Wm. Penn Tatham.	Leeds, England	April 9
Ploughs	Joseph B. Cooper	Brooklyn, N. Y	April 9
Planters, Corn	Wm. C. Ford	West Salem, Ohio	April 9
Ploughs	Henry F. Mann	Laporte, Ind	April 16
Planters, Corn	David Humphreys	Cincinnati, Ohio	April 16
Planters, Seed	Lewis R. Wright, assignor to self and Thos. R. Howard.	Cohoes, N. Y	April 16
Ploughs	Franklin Traxler	Salem, Mich	April 16
Planters, Corn	J. Stone and J. T. Archibald	Wapello, Iowa	April 16
Planters, Corn	Powers Ritchey	Hamilton, Ill	April 16
Ploughs	Geo. W. Cooper	Palmyra, Ga	April 16
Planters, Corn	James M. Foy	Fountain Green, Ill	April 16
Planters, Seed	Thomas W. White	Milledgeville, Ga	April 16
Planters, Seed	Daniel Bray	Canton, Mo	April 23
Ploughs, Subsoil	James McCollum	Burnsville, Ala	April 23
Ploughs, Steam	John K. Smith	Trenton, N. J	April 23
Ploughs	Edwin J. Fraser	Kansas, Mo	April 23
Planters, Corn	Charles K. Myers, assignor to self and John Cohenour.	Pekin, Ill	April 23

* English patent, September 8, 1856.

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Potatoes, Machines for digging	S. B. Conover and Marshall Spring.	New York, N. Y.	April 30
Ploughs	Valentine Felker, assignor to self and Rufus Jones.	Carmel, Mo	April 30
Planters, Hand corn	Silas P. Briggs	Saratoga Springs, N. Y.	April 30
Planters, Corn	H. J. Howe	Oraga, Ill	May 14
Ploughs	Thomas Patterson	Rush, Ill	May 14
Planters, Corn	Aaron Cotton	Attica, N. Y	May 28
Ploughs, Steam	S. L. Shotwell and S. R. Hicks.	Ottawa, &c., Ill	May 28
Ploughs	L. M. Stearns	Cardiff, N. Y	June 4
Ploughs	Z. M. Beall	Russelville, Ky	June 4
Paring and pulverizing the soil, Machines for.	Richard J. Gathing.	Indianapolis, Ind	June 18
Ploughs, Hill-side	Augustus Sanborn	Glover, Vt.	June 18
Ploughs, Steam	Cyrus W. Saladee	Pine Island, Texas	June 25
Ploughs	William Lape, assignor to self and F. R. Stow.	Troy, N. Y	June 25
Planters, Hand corn	S. Z Shores	Towanda, Pa	July 2
Ploughs	T. S. & T. W. Rappelye	Farmer, N. Y	July 2
Ploughs	Canfield Blodgett	Morrison, Ill	July 9
Ploughing and tilling land, Machinery for.	John Fowler, jr., assignor to Wm. Penn Tatham.	England	*July 9
Potato-diggers	F. A. Morley	Sodus Point, N. Y.	July 9
Pruning-shears	Joseph Evans	San José, Cal	July 16
Planters, Seed, Shoes for	A. W. Brinkerhoff	Upper Sandusky, Ohio	July 16
Ploughing and tilling land by steam, Drums or pulleys to prevent ropes from slipping in machinery for.	John Fowler, jr., Robert Burton, David Griggs, and Jeremiah Head, assignors to Wm. Penn Tatham.	England	†July 23
Ploughs for draining and subsoiling	Loure Green	Great Bend, Pa	July 23
Ploughs, Seeding	W. P. Penn	Bellville, Ill	July 30
Ploughs, Gang	J. F. & W. L. Black	Lancaster, Ill	July 30
Ploughs	John Dement	Dixon, Ill	July 30
Planters, Hand corn	William Douglass	Westport, Mo	July 30
Planters, Hand corn	J. W. Campbell	Loomisville, Mich.	August 6
Ploughs	Henry S. Chichester	Brunswick, N. Y.	August 6
Planters, Corn	Adam Brightbill, assignor to self and John Brightbill.	Bethel Township, Pa	August 6
Planters, Seed	T. B. & B. N. Rockwell	Batavia, Ill	August 13
Potato-diggers	Perry Marcy	Tunkhannock, Pa	August 20
Planters, Seed	Joseph F. Pond	Cleveland, Ohio	August 20
Ploughs	Chas. O'Brian and Henry Kreps	Minerva, Ohio	August 20
Plough, Clevis	R. A. Blair and John B. Reed.	New Philadelphia, Ohio.	August 20
Ploughs, Subsoil	William H. H. Burnham and Samuel B. Pierce.	Homer, N. Y	August 27
Planters, Corn	G. D. Haworth	Decatur, Ill	September 3
Planters, Corn	J. A. C. & A. S. Hickman	Summerfield, Ill.	September 3
Ploughs	Henry D. Martin	Ypsilanti, Mich	September 10
Planters, Corn	Rodney Welch	Worth, Ill	October 1
Picks, &c., Method of attaching handles to	William H. Livingston.	New York, N. Y	October 1
Ploughs	N. F. Burton	Plymouth, Ill	October 29
Ploughs	R. Coddington and D. McCall.	Kalamazoo, Mich	October 29

* English patent July 14, 1858. † English patent January 24, 1859.

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Planters, Corn	D. B. Abbey	Horseheads, N. Y	November 12
Planters, Corn	Charles E. Paxson	Salem, Ohio	November 26
Plants and fruits, Method of growing.	Alfred C. Chamberlain	Newport, R. I	November 26
Ploughs, Corn	William B. Ready	Sacramento Cal	December 3
Ploughs	Wilkinson Furnas	Ononway, Iowa	December 3
Ploughs, Steam	J. W. Fawkes	Decatur, Ill	December 10
Ploughs	L. W. Shaffer	Shelbyville, Ky	December 10
Roots, Machines for cutting	William C. Berry	Woodbridge, N. J	January 1
Rollers, Field	James C. Pease	Sycamore, Ohio	January 8
Rakes for reapers	M. C. Brelsford	Girad, Ill	January 15
Reaping-machines, Hand-rake for	George Esterly	Whitewater, Wis	January 15
Rake heads	J. C. Stoddard	Worcester, Mass.	February 12
Reaping and mowing machines, Guards or fingers for.	Salem Copeland	Worcester, Mass.	February 19
Rakes, Horse	Davis B. Woodward	East Fallowfield, Pa	February 19
Reaping and mowing machines	Cyrenus Wheeler, jr	Poplar Ridge, N. Y	March 12
Rakes, Horse	Jonah Crites	Orville, Ohio	April 2
Rakes, Hay	William Deckman	Canton, Ohio	April 16
Reapers and Mowers	D. Hitchings	Otsego, N. Y	April 30
Rakes, Horse	Samuel Mowry	Womelsdorf, Pa	May 14
Rakes, Hay	E. P. Barton and R. W. Towles	Bath, N. Y	July 9
Rakes, Hay	Charles R. Soule	Fairfield, Vt	July 9
Rakes, Hay	Francis G. Willson	Ontario, Canada West	July 30
Rakes, hay, Hand	J. C. Stoddard, assignor to self and W. A. Hacker.	Worcester, Mass.	August 6
Reaping-machines	Welcome Sprague, assignor to self, Daniel E. Barker, and Wm. Van Duzen.	Farnham, N. Y	August 6
Rakes, Horse	Edward Buckman	East Greenbush, N. Y	September 3
Rakes, Horse	Edward Smith and Sidney Cowles.	Northfield, Conn	September 10
Rice cleaning machines	Albert H. Wright	New York, N. Y	September 10
Reaping and mowing machines	Lambert Espelding, assignor to Cyrus H. McCormick.	Chicago, Ill	October 1
Reaping and mowing machines, Metallic finger beams of.	Cyrus H. McCormick	Chicago, Ill	November 5
Reaping and mowing machines	Cyrus H. McCormick	Chicago, Ill	November 5
Reaping and mowing machines, Cutting apparatus of.	Wm. S. McCormick, assignor to Cyrus H. McCormick.	Chicago, Ill	November 5
Reaping and mowing machines, Cutters for.	Wm. S. McCormick, assignor to Cyrus H. McCormick.	Chicago, Ill	November 5
Reaping-machines	John Tustin	Petaluma, Cal	November 12
Roots, Machines for cutting	Jacob Widner, asignor to H. B. Bigelow.	New Haven, Conn	December 10
Straw-cutters	Wm. Newbury	Clarksville, Mo	January 1
Seeding-machines	E. Eggleston	Beloit, Wis	January 1
Seeding-machines	W. B. Quarton	Clarksville, Ill	January 8
Separators, Grain	Ellis Michael, assignor to A. and J. W. Free.	Laporte, Ind	January 8
Seeding-machines	David Pardee	Carlyle, Ill	January 8
Seeding-machines	Worden P. Penn	Belleville, Ill	January 8
Seeding-machines	G. W. Lee and A. R. Reese	Phillipsburg, N. J	January 15
Separators, Grain	A. Fauckboner	Schoolcraft, Mich	January 15
Straw-cutters	Ira Reynolds	Bellefontaine, Ohio	February 5

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Separators, Grain	Jefferson Nash, assignor to self and Alonzo K. Cutts.	Janesville, Wis	February 12
Seeding-machines	T. B. Jones	Earlville, Ill.	February 12
Seeding-machines	C. W. Foster, assignor to self and J. Balsburgh.	Freeport, Ill.	February 12
Straw-cutters	O. C. Taylor	East Burlington, Pa	February 12
Seeding-machines	J. M. Bacon	Ripon, Wis	February 19
Seeding-machines	Perley D. Cummings, assignor to D. H. Furbish.	Portland, Me	February 26
Separators, Grain	J. Mathews, assignor to self and Henry Egolf.	Middletown, Pa	February 26
Seeding-machines	Nelson Ford	Cambridge, Wis	February 26
Separators, Grain	E. Davis and Alonzo Palmer	Hudson, Mich.	March 5
Straw-cutters	U. S. Stuart and C. E. Stuart.	La Grange, Tenn	March 5
Separators, Grain	Byron Rice	Schuyler, N. Y	March 12
Seeding-machines	Ira A. Stafford	Essex, N. Y.	March 19
Separators, Grain	Wm. E. Gaunt and Botsman B. Hinman.	Keokuk, Iowa	March 19
Straw-cutters	Geo. U. and John Relyea	Veteran, N. Y.	March 19
Separators, Grain	Linus Merrill	Janesville, Iowa.	April 9
Seeding-machines	C. W. Cahoons	Portland, Me	April 9
Separators, Grain	G. B. Twiner and Jas. A Vaugh.	Cuyahoga Falls, Ohio	April 9
Separators, Grain	Andrew Hunter	Solano co., Cal	April 9
Seeding-machines	F. M. Bacon and Jos. Fowler.	Ripon, Wis	April 16
Separators, Grain	S. M. Wirtz and F. Swift	Hudson, Mich.	April 16
Straw-cutters	Otis B. Wattles	Mooresboro', N. C.	April 16
Separators, Grain	George Lull	Harding, Iowa	April 16
Seeding-machines	T. S. Mills	Iberia, Ohio	April 23
Spading-machines, Rotary	Donald Mann	Rochester, N. Y	April 23
Seeding-machines	George Harlan	Brownsville, Ind	April 30
Seeding-machines	Henry K. Stoner	Lancaster, Pa	May 14
Shafting, Hangers for	Martin H. Mansfield	Ashland, Ohio	May 14
Separators, Grain	Charles B. Martin	Fond du Lac, Wis.	May 28
Sowing guano, Machines for	S. B. Black	Harrisburg, Pa	May 28
Separators, Grain	John A. Scott, assignor to self and S. P. Robins.	Rochester, N. Y	May 28
Seeding-machines	M. Grout and C. Lawton	Oak Grove, Wis	June 4
Seeding-harrows	Edward Budlam	Ogdensburg, N. Y	June 18
Seeding-machines	Gilbert Jessup	Chapinville, N. Y	June 25
Separators, Grain	H. H. Seeley and P. Griswold.	Hudson, Mich	July 2
Seeding-machines	A. C. Stiles, assignor to self and A. Ewbanks.	Bunker Hill, Wis	July 9
Separators, Grain	Andrew J. Vantuyl	Hector, N. Y	July 2
Sowing pulverized manures, Machines for.	N. G. Swift	Hart's Village, N. Y	July 9
Seeding-cultivators	A. P. Durant	Atlanta, Ill	July 16
Separators, Grain	A. H. Merrill	Ypsilanti, Mich	July 23
Straw and hay-cutters	John D. Cochran	Milford, N. H	July 30
Sowing-machines	Alonzo Webster	White River Junction, Vt.	August 6
Spading-machines	Isaac C. Crane	Bronson, Mich	August 6
Seeding-machines	M. L. Gorham	Winnebago Station, Ill.	August 6
Straw-cutters	John R. Whittemore	Chicopee Falls, Mass	August 20
Seeding-machines	H. N. Dalton	Jacksonville, Cal	August 20
Straw-cutter	Horace R. Hawkins	Akron, Ohio	August 27

Agricultural inventions or discoveries for 1861—Continued.

Inventions or discoveries.	Inventors.	Residence.	Date of patent.
Seeding-machines	Earll Bellinger	Hickory Corners, Mich.	September 10
Separators, Grain	H. H. Beach	Philadelphia, Pa	September 10
Separators, Grain	Jacob Meyer	Chicago, Ill	October 22
Separators, Grain	Wm. Medd Watson	Tonica, Ill	October 29
Seeding-machines	T. R. Richmond	Massillon, Ohio	November 5
Separators, Grain	A. H. Dixon	San Francisco, Cal	November 5
Separators, Grain	J. Farguson	Dubuque, Iowa	November 5
Seeding-machines	G. W. Van Brunt	Rolling Prairie, Wis	November 12
Separators, Grain	Aaron Higley	Sand Creek, Minn	December 3
Subsoil, Machine for breaking the	Louis Jacques Chateau	Paris, France	December 10
Seeding-machines	Jacob Early and J. B. Parrin	Hightstown, N. J.	December 10
Threshing-machines, Gearing for	Lewis Miller, assignor to C. Aultman & Co.	Canton, Ohio	March 19
Threshing-machines, Fan attachment for.	W. C. Rentgen and P. H. Humes.	Keokuk, Iowa	March 26
Threshing-machines, Straw-carriers for.	G. Weiland, assignor to self and Francis Fisher.	Buffalo, N. Y	March 26
Threshing and separating grain, Machines for.	Cyrus Roberts	Belleville, Ill	April 16
Threshing-cylinder, corn-sheller, and grinding-mill, Arrangement of.	Charles Bailey	Batavia, Ill	April 23
Threshing and cleaning clover, Machines for.	Wm. Rowe	Charlestown, Va	April 30
Threshing-machines	S. E. Oviatt	Richfield, Ohio	May 14
Threshing and separating grain, Machines for.	Hiram Aldridge	Michigan City, Ind	June 11
Threshing-machines	Worden P. Penn	Belleville, Ill	June 18
Tilling lands by steam, Machines for	John Fowler, jr., and Wm. Worby, assignors to Wm. Penn Tatham.	England	July 9; Engl'h patent dated July 10, '56
Threshing and separating machines, Grain.	Jacob Seebold	New Berlin, Pa	July 23
Thresher and cleaner of grain	Wm. Pierpont	Salem, N. J	August 13
Threshing-machines, Straw-carriers for.	Levi Bronson, assignor to self and James Brayley.	Lockport, N. Y	August 13
Threshing-machines	P. H. Standish	Santa Clara, Cal	August 20
Threshing-machines	Penj. Hyle and A. Ralston	Martin's Ferry, Ohio	August 27
Threshing-machines, Straw-carriers of.	Merritt P. Morgan	New York, N. Y	October 8
Threshing-machines	C. H. Shank and S. Stephenson.	Hummelstown, Pa	November 12
Threshing-machines	Benjamin Hoyle	Martin's Ferry, Ohio	December 10
Threshing-machines, Straw-carriers and grain-separators for.	Wm. Pierpont	Salem, N. J	December 24
Winnowers, Grain	Henry H. Beach	Philadelphia, Pa	June 11
Winnowing-machine	Jared K. Buck	Winona, Minn	July 23
Winnower, Grain	James J. Shafer	Burlington, Iowa	August 6
Winnowing-machines, Screens of	Wm. Medd Watson	Tonica, Ill	October 29
Weaning calves, Device for	J. J. Welling	Cedar Falls, Iowa	December 10
Yokes, Ox	Thomas W. Porter	Bangor, Me	June 25
Yokes, Ox	M. W. Mason	Elbridge, N. Y	August 6

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ERRATA.

For "Richard S. Tray," p. 130, read RICHARD S. FAY.

For "Translated from the French by C. Willemot," p. 223, read "Translated from the French of C. Willemot."

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